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Worcester Foodscape: Analysis of Adolescent Food Choices

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ABSTRACT

To learn more about the attitudes of high school students towards food, we conducted multiple focus groups and interviews with local high school students. To assess the impact of the foodscape on student food choices, we mapped food retail outlets in relation to schools and school bus stops. Student's food choice in Worcester is complex and is influenced by advertisements, peer pressure, easy access to junk food, acculturation, and economic considerations.

ACKNOWLEDGEMENTS

EXECUTIVE SUMMARY

Obesity has been classified as a national epidemic in the United States. It is a condition that greatly increases the chances of suffering from other chronic diseases such as diabetes, hypertension, and cancer. These not only have a familial, local impact, but they also affect society at a large scale as well, especially in healthcare spending. Extensive research has been done on the many factors that may lead to obesity.

According to the Worcester Food and Active Living Policy Council (WFALPC), in Worcester 40% of the children from first grade to eleventh grade are either overweight or obese. This statistic is of concern to policy makers in the city because there are increased chances that this population will suffer from chronic diseases in the future.

Our project initially focused on adolescent obesity. We sought to identify how Worcester teenagers themselves understood the issue through more of an active research focus. In the course of our interactions with teenagers from Worcester's Boys and Girls Club, we found that they were more interested in discussing their food choices and their attitudes toward food. Working closely with the high school students, we explored the environmental and social factors that inform their choices.

Environmental Factors

Environmental factors play a significant role in eating behaviors. Over the years, it has been shown that there has been a shift from a physically active lifestyle towards a more sedentary one due to technological advances. In addition, there has been an increase in the number of outlets that sell food of low nutritional value, such as fast food restaurants and corner stores. Some areas have even been termed "food deserts", because they lack access to healthy food. Unfortunately, these deserts are more predominant in areas of low economic income, especially where the Black and Hispanic communities reside.

Advertisement is another aspect of food companies that have targeted children and adolescents. Adolescents and children view over 3000 ads a day through mediums such as television, internet, magazines and billboards. Companies even use techniques such as placing products in popular movies or using celebrity endorsement to promote their items (Committee on Communications,

2006). Ads do not generally promote healthy foods and they make fast food products look appealing.

To assess the impact of the foodscape on student food choices, we mapped food retail outlets in relation to schools and school bus stops. This was done to determine if fast food outlets and corner stores cluster around the schools in order to influence the student's food choice.

Social Factors

Social factors also have a significant impact on eating behaviors. The last few decades have witnessed a change in household dynamics, especially since both parents work. This has enhanced the convenience aspect of fast food, therefore introducing unhealthy eating patterns in the family. Peer influence poses a significant influence in eating behaviors as well.

The appearance of food also plays into the psychology behind adolescent food choices because it is the making or breaking point in the sales of products (Moss, 2013). Not only are companies playing into the psychology of food but they are also using science and human physiology to create addiction to these unhealthy products. The food industry has been compared to the tobacco industry for advertising harmful items to children and making them addicted (Moss, 2013).

The Keystone group was given food diaries for a week in which they recorded their meals and snacks and the people they shared the meal with. Afterwards, we carried out focus groups with the Keystone Group in which the participants talked about how the household, their schedules, and peers influence their food consumption.

Findings

The Keystone group consisted of seven girls, ranging from 14 to 17 years of age.   The participants came from either a Black or Hispanic background. The students provided us with information on food choices and the social meaning of food. Many of the students found body image and social pressures to be relevant to their experience. The group was composed of all girls who commented that often times girls would give away their school lunches to boys. This was because girls were focused on staying thin while boys who were sometimes athletes would intake more food to stay in shape.

The general eating habits of the group were discussed and it was discovered that many of the students did not eat three meals a day. The students shared that on a typical school day, they would sometimes eat breakfast and lunch but often times skip dinner. It was found that most of the Keystone group does not eat at school. Instead they wait until they get home to eat and they had several reasons for this. Some of them will skip school breakfast or lunch because they just have no desire to eat what the school serves.

It was revealed that students bought themselves snacks from corner stores. There is a corner store located within a five-minute walk of the Boys and Girls club where the students purchase items like Arizona Ice Teas, pastries, chips and other snacks. They mentioned that convenience played a large role in their decision to go to the corner stores. They were also intrigued by the idea of a cheap, quick snack and were even willing to travel through a dangerous neighborhood by themselves to get a snack.

The social factors previously discussed also act hand in hand with environmental factors such as advertisements and proximity of fast food outlets and corner stores when influencing adolescents' food choices. Several of the Keystone members mentioned how commercials are tempting and make them want to eat fast food.

In order to relate the findings on food choices of the Keystone group with the Worcester foodscape, high schools, middle schools and elementary schools were put on separate GIS maps along with various food outlets such as fast food, corner stores, pharmacies, gas stations with food courts, and malls. A GIS map containing the departure bus stops for Worcester high schools was also created. Although all of these points were put on the map, the proximity of fast food outlets, corner stores and gas stations around high schools, middle schools and departure bus stops was the main focus of the project. About 30 percent of fast food outlets, 40 percent of corner stores and 20 percent of gas stations in Worcester are within a half-mile of a high school. The food outlets were mainly on major roads, which lead to the schools, therefore providing a possible influence on the students' appetite for a quick meal when they are heading to or back from school.

Although we gained insight into the food choices and attitudes of the Keystone group, there were limitations with our study. It would be useful to have a larger sample, to include students from other socio-demographic groups, and to solicit the opinions of high school boys.   The findings from this project, we hope, can be used to develop educational materials and high school discussion about healthy eating.

AUTHORSHIP

Elena Banegas wrote the Introduction of the report. She wrote the Executive Summary in collaboration with Bethany Burke. She also wrote the following sections in the Background Chapter: Obesity affects population groups differently, Obesity is also an issue in Worcester, Obesity is a Multidimensional Issue, and Analysis of Data Method. In addition, in the Findings section, she wrote the Introduction, the "Advertisements", and the "Evaluating the Foodscape" sections. Elena Banegas also edited the findings chapter. Elena Banegas, along with Jennifer Zehnder, led and facilitated the focus group discussions. In addition, she also aided in the creation of the storyboard that was be the basis for the final video, one of the deliverables of our project. Along with Bethany and Jennifer, Elena also recorded the video. Elena Banegas took the role of editor for most of the document.

Bethany Burke wrote on the social factors, including the body image and appeal of food section in the background chapter. She wrote the Executive Summary in conjunction with Elena. She also contributed to the findings including the sections on social factors, food choices outside the home and snacking. She also wrote the conclusion. Bethany was the main secretary during the focus groups and wrote summaries of the sessions.

Frank Gleason worked mainly on the Geographic Information System (GIS) map of Worcester, MA along with sections that had to do with evaluating the foodscape of Worcester in both the Background and Findings chapters. Frank also authored the abstract and recommendation sections.

Jennifer Zehnder was responsible for numerous sub sections of the report. In the background, Jennifer Zehnder wrote the sections "food availability around schools", convenience, and parental influence. In the findings section, Jennifer Zehnder wrote "influence of schedules on food choices" and family playing a role. Jennifer Zehnder also edited the introduction, abstract, executive summary, and conclusion and recommendations of the paper. Along with Elena, she also helped to edit the whole document. Jennifer Zehnder was also a key leader in running the focus group sessions with the Boys and Girls Club. In the methodology, the team equally wrote and edited the section.

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1.0 INTRODUCTION

Obesity has been classified not only as a national, but a global epidemic by the World Health Organization (World Health Organization, 2000). Overweight and obesity-conditions affect an estimated 97 million Americans and are the second leading cause of preventable death in the United States (Pi-Sunyer et. al, 1998). Figure 1 shows the percentages of obesity by state for the year 2011. It is a condition that greatly increases the chances of suffering from other chronic diseases including hypertension, adverse lipid concentrations, type two diabetes, and several types of cancer such as prostate, breast, and colon cancers (Pi-Sunyer et. al, 1998).
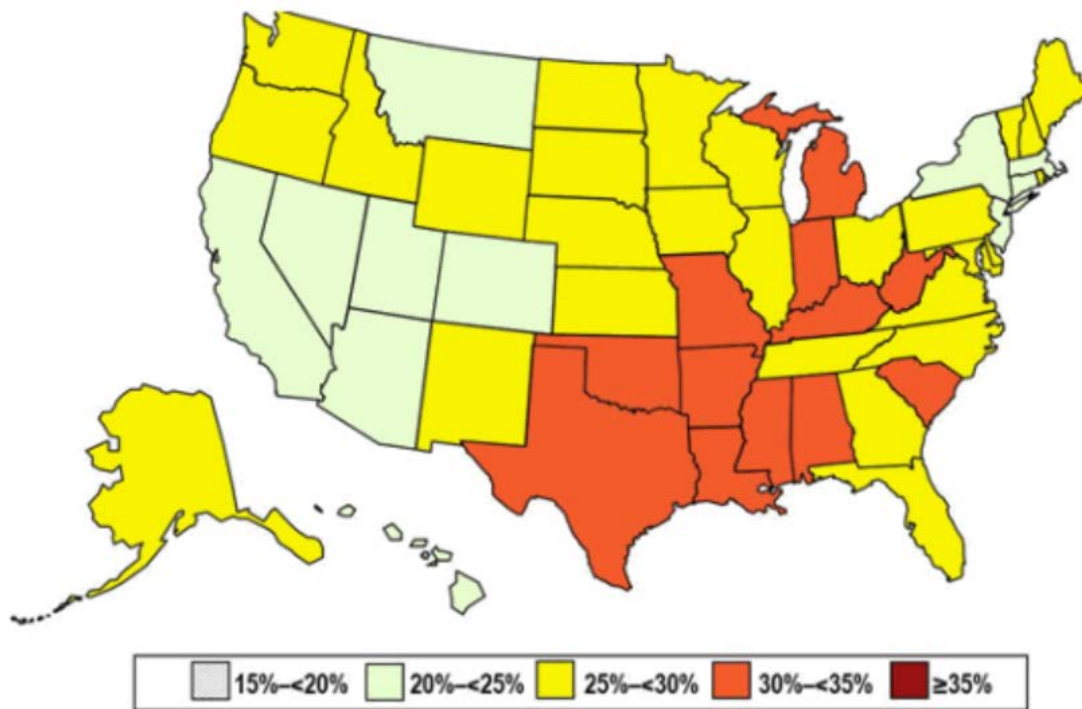
Figure 1: Self-reported obesity among U.S. Adults, 2011
http://www.cdc.gov/obesity/data/adult.html

Obesity has constantly been rising; however, it affects some groups more than others. Non-Hispanic blacks have the highest age-adjusted rates of obesity (49.5%) compared with Mexican Americans (40.4%), all Hispanics (39.1%) and non-Hispanic whites (Odgen et al., 2012). An interesting finding from a study by the CDC shows that most obese adults are not low income (below 130% of the poverty level) (Odgen et al., 2012).

1.1 Factors that lead to Obesity

Obesity presents serious consequences for both the patients and society and affects more groups than others, but what causes it? Extensive research has been done on the many factors that may lead to obesity; however, it is a multidimensional issue that encompasses both environmental and social causes (Sokol, 2000).

Over the past four decades, there has been a shift from a physically active lifestyle towards a more sedentary one due to technological advances. Not only there is a decrease in physical activity, but also the area available for children to exercise is limited in neighborhoods nowadays, especially low-income neighborhoods (Sokol, 2000).

Changes in lifestyle in addition to the food available also contribute to the obesity epidemic. The food industry nowadays produces a large quantity of unhealthy snacks that are high in fat, sugar, and salt (Figure 2). There has also been an increase in the number of outlets that sell food of low nutritional value, such as fast food restaurants and corner stores (Figure 3). Some areas have even been termed "food deserts", which are low-income neighborhoods that lack easy access to supermarkets and other retail outlets to buy healthy foods (Campbell, 2004).

Figure 2: Variety of Unhealthy Snacks
http://www.nextgenerationfood.com/media/media-

Figure 3: A photo depicting a food desert
http://cdn3.spiegel.de/images/image-139202-galleryV9-

However, it is not only the amount and proximity of fast food outlets, but also the advertisements they distribute through media such as TV, radio, and the Internet that poses a great influence in a person's food choice (Mikkelsen, 2011).   For example, Adolescents and children view over 3000 ads a day through mediums such as television, Internet, magazines and billboards (Committee on Communications, 2006).

While environmental factors influence food choice, social factors also have a significant impact on eating behaviors. The last few decades have witnessed a change in household dynamics, especially since both parents work (Sokol, 2000). This has enhanced the convenience aspect of fast food, therefore introducing unhealthy eating patterns in the family.

1.2 Obesity in Worcester

In Worcester alone, 40% of the children from first grade to eleventh grade are either overweight or obese (WFALPC, 2013). This statistic is of concern to policy makers in the city because there are increased chances that this population will suffer from chronic diseases in the future.   Figure 4 shows the percent of obesity rates in first and eleventh grade. The Hispanic population in Worcester seems to have higher obesity rates in comparison to other races or ethnicities.
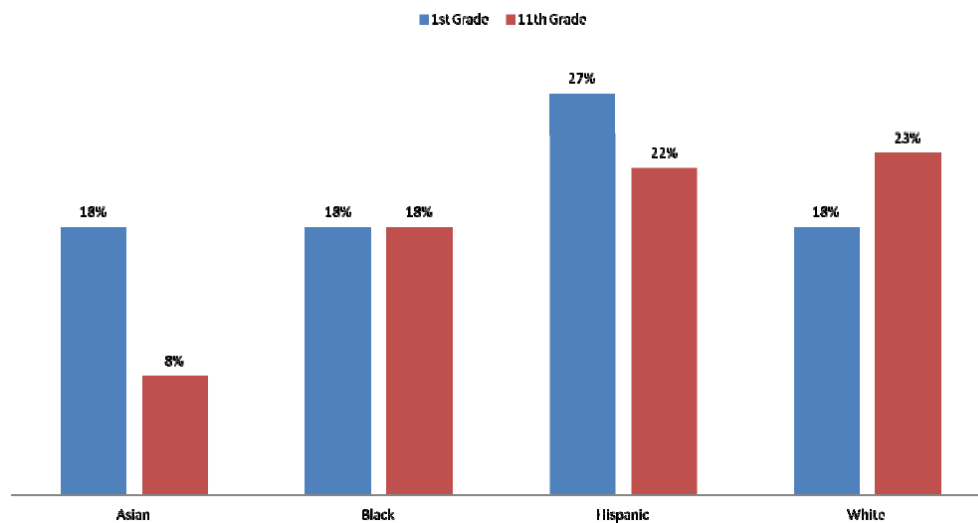
Figure 4: Obesity in Worcester public schools, 2011
http://www.worcesterma.gov/uploads/88/76/8876150daa6d86a6ac9bfd6b93b7ddf3/health-of-worcester-report.pdf

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1.3 Exploring adolescents' food choices

As previously mentioned, research has shown that many factors lead to obesity, such as the proximity of fast food outlets and corner stores and convenience (He et al., 2012).   However, little research has been done on what influences the students' food choice, habits that over the years may lead to obesity. The School Foodscape project sought to gain a deeper understanding of the complex phenomena behind food choice in adolescents. The team wanted to know the how these teenagers relate to food and what do they perceive as food's intrinsic nature. Is it only a matter of feeling satisfied? Is eating a way to make connections and build relationships? Do they feel influenced or even pressured by family, peers, or advertisements to make certain food choices?

To explore these questions and learn more about high school students' behavior and attitudes towards food, the team carried out focus groups and conducted in-depth interviews with local high school students in which they talked about how their households, schedules, advertising and peers influence their food choices. To assess the impact of the physical foodscape on student food choices, the team performed a geographical analysis of the Worcester area by mapping the location of fast food outlets and corner stores in relation to school location and school bus drop off points. By knowing "the why" of adolescent food choices, the team hopes these findings may lead to initiatives that address the rising obesity problems in the city of Worcester.

2.0 BACKGROUND

The core of our project focuses on understanding and analyzing the factors that affect adolescent's food choices. These include: parental behaviors, peer influences, targeted advertising and convenience offered by fast food outlets and corner stores. The following section will give an overview of the trends and causes of obesity. We then examine the social and environmental factors associated with obesity, and discuss the research that shows the impact of corner stores and fast food restaurants on adolescent food choices. We then consider research strategies to help explore adolescent food choices and perceptions about healthy and unhealthy food.

2.1 Obesity affects population groups differently

Obesity takes a heavy physical, social, and emotional toll on the population (Ebbeling et al., 2002). Researchers have quantified it by using the body mass index (BMI), which is calculated as weight in kilograms divided by height in meters squared. Overweight is defined as a body mass index (BMI) of 25 to 29.9 and obesity as a BMI of 30 (CDC, 2011). Obesity is a serious chronic disease because it affects 37.5 % of the population.

Obesity not only has an impact on the individual level, but it also affects society at a large scale through the increasing cost of healthcare. The Behavioral Risk Factor Surveillance System (BRFSS) by the CDC (Centers for Disease Control and Prevention) revealed that obesity rates increased by 37 percent between 1998 and 2006 (from 18.3 percent to 25.1 percent of the population). This suggests that the increased prevalence of obesity is driving increases in total medical spending. In 1998 the medical costs of obesity were estimated to be as high as $78.5 billion, however, the medical costs of obesity are estimated to have risen to $147 billion per year by 2008. The medical costs for people who are obese were $1,429 higher than those of normal weight (Finkelstein, 2009).

Obesity affects the population by certain age groups. Figure 5 shows the percentage of men and women that are obese with respect to particular age groups. Adults aged 60 and over were more likely to be obese than younger adults.
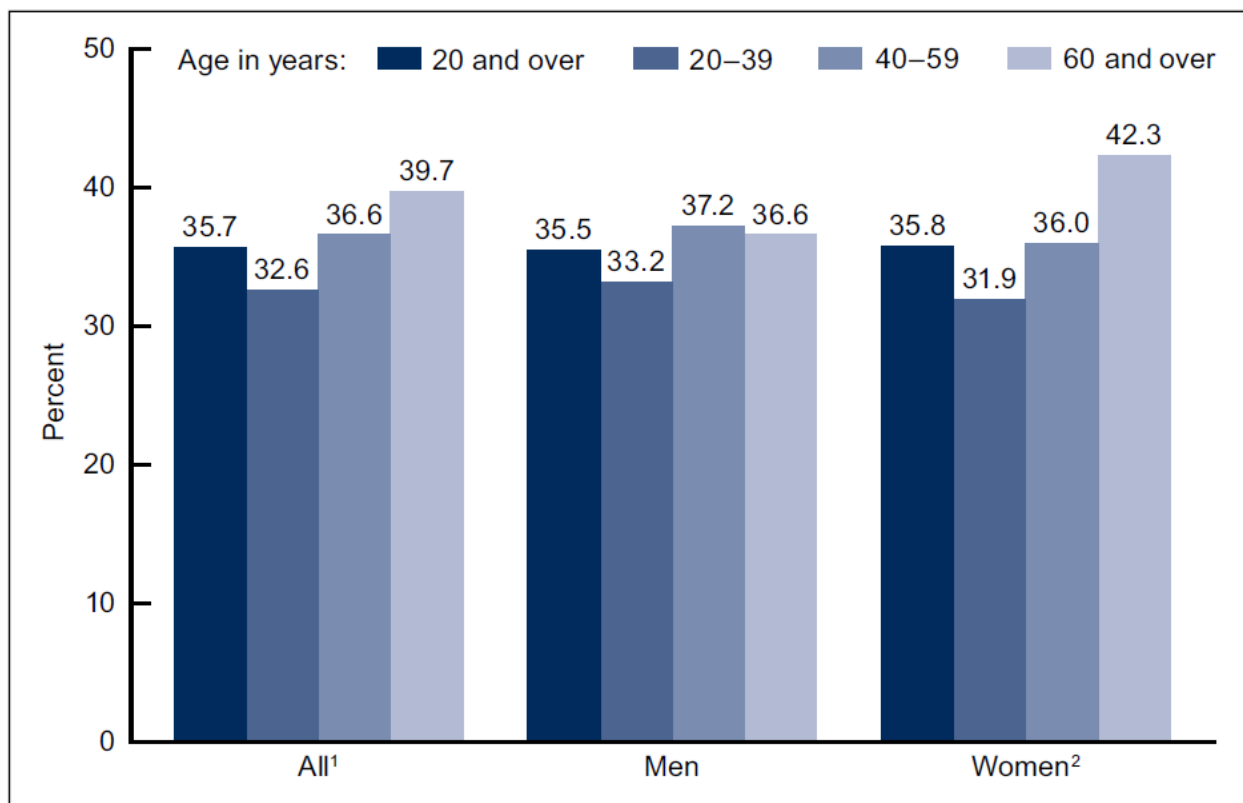
Figure 5: Obesity trends by age and gender for 2009-2010 (CDC)
http://www.cdc.gov/nchs/data/databriefs/db82.pdf

Figure 5 shows there is no significant relationship between obesity and education among men. Among women, however, there is a trend—those with college degrees are less likely to be obese compared with less educated women (CDC, 2011).

An interesting study by Odgen reveals that most obese adults are not low income (Figure 6). Of the approximately 72 and a half million adults who are obese, 41% (about 30 million) have incomes at or above 350% of the poverty level, 39% (over 28 million) have incomes between 130% and 350% of the poverty level, and 20% (almost 15 million) have incomes below 130% of the poverty level. Among both men and women, most of the obese adults are non-Hispanic white with income at or above 130% of the poverty level. Approximately 21 million non-Hispanic white men and almost 21 million non-Hispanic white women who have incomes at or above 130% of the poverty level are obese.

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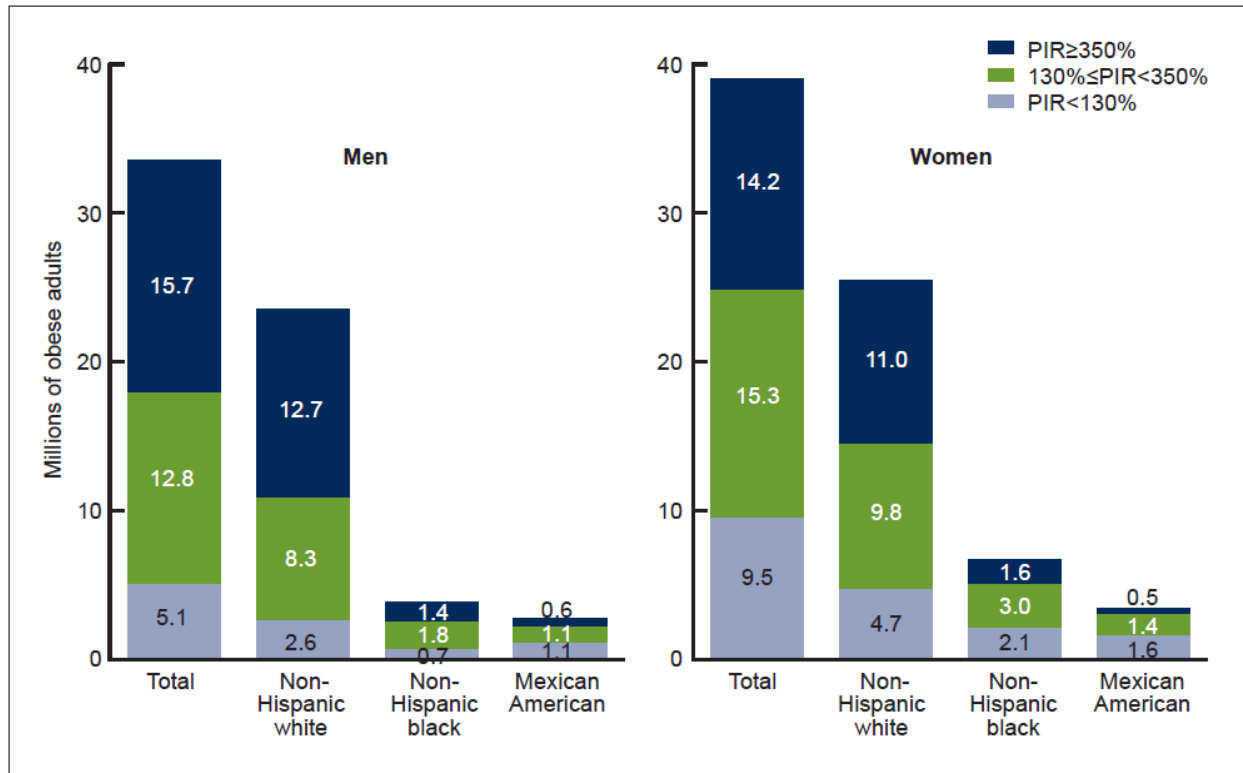
Figure 6: Obese adults aged 20 years and over, by poverty income ratio (PIR) and ethnicity.
http://www.cdc.gov/nchs/data/databriefs/db50.pdf

Obesity trends do not only vary with age and income level, but also with education level. Among men, 27.4% of those with a college degree are obese compared with 32.1% of those with less than a high school education, although the difference is not statistically significant (Figure 7). Among women, 23.4% of those with a college degree are obese, significantly less than the 42.1% of women with less than a high school education. There are no significant differences in obesity prevalence by education level among non-Hispanic black and Mexican-American men.
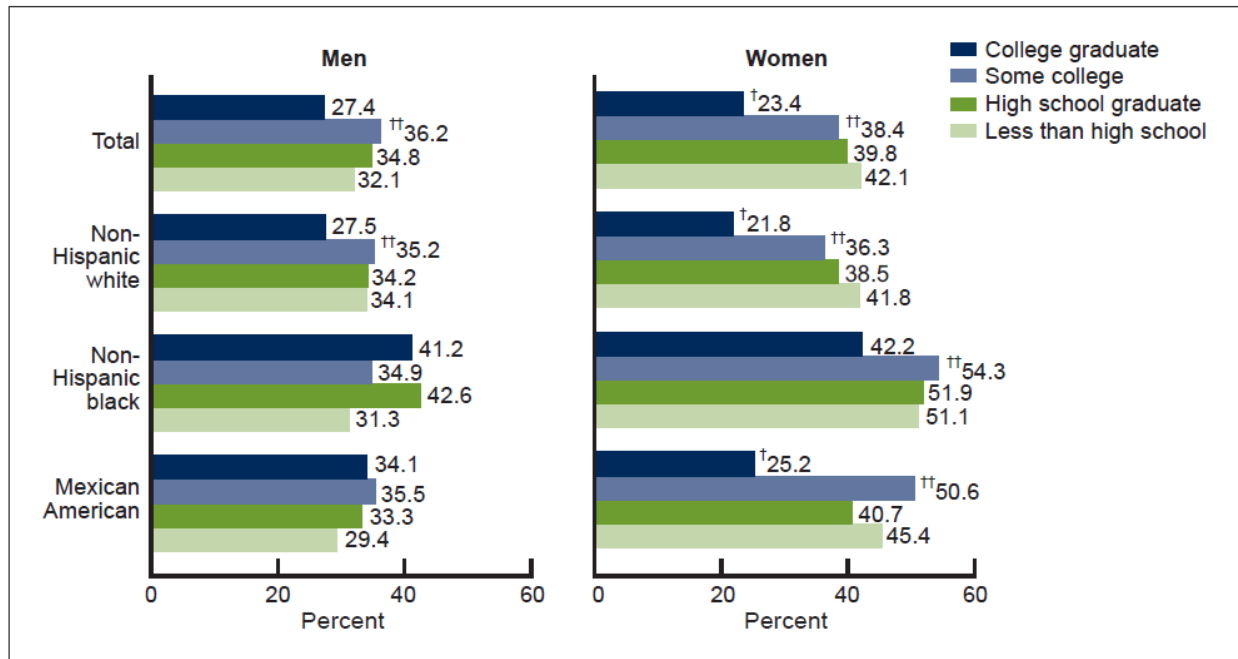
Figure 7: Prevalence of obesity among adults aged 20 years and over, by education, sex, and race and ethnicity; United States 2005-2008
http://www.cdc.gov/nchs/data/databriefs/db50.pdf

Youth who are overweight or obese have a higher possibility of remaining overweight or obese into adulthood, increasing their risk of disease and disability later in life (Singh et al., 2008). As Figure 8 shows, 16.9% of U.S. children and adolescents were obese. The prevalence of obesity was higher among adolescents than among preschool-aged children. The prevalence of obesity was higher among boys than girls (18.6% of boys and 15.0% of girls were obese) (Ogden et al., 2012).
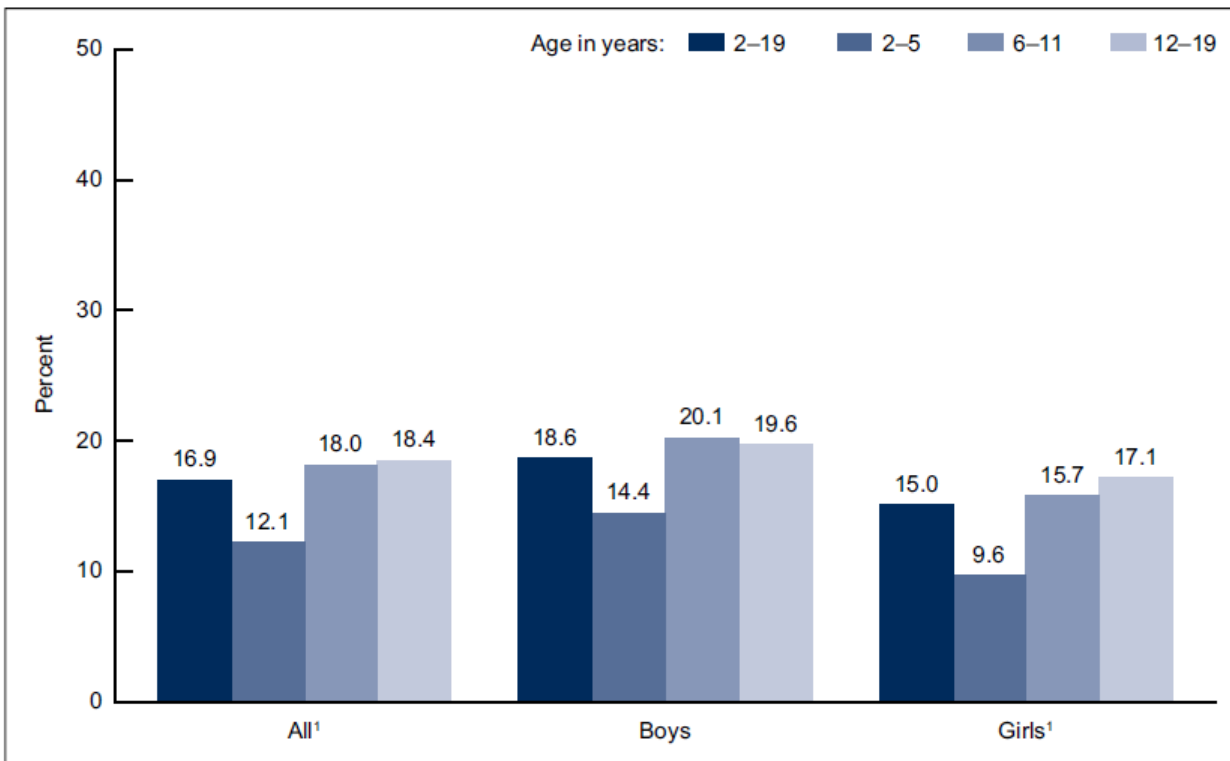
Figure 8: Prevalence among children and adolescents aged 2-19, by sex and age: United States, 2009-2010
http://www.cdc.gov/nchs/data/databriefs/db82.pdf

Statistical data shows that obesity is more common in boys than girls (19% versus 15%). With respect to ethnicity, Hispanic (21%) and non-Hispanic black (24%) youth have higher rates of obesity than non-Hispanic white youth (14%), a continuing trend (Ogden et al., 2012).

2.2. Obesity is also an issue in Worcester

The division of public health in Worcester has published data on the obesity rates in the city. Figure 9 shows how obesity has increased from 16% to a 25% in less than 10 years. In addition, it also shows how Worcester has a higher incidence of obesity in comparison to the average rate of the state of Massachusetts.
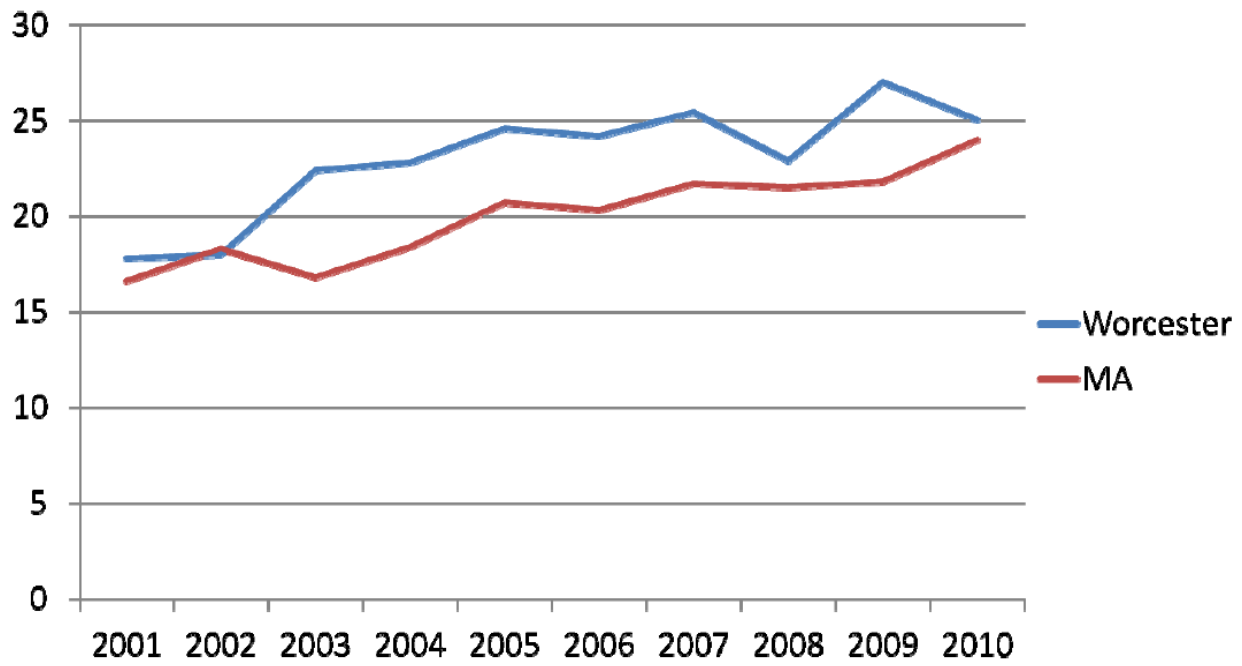
Figure 9: Obesity among adults for Worcester and Massachusetts, 2010
http://www.worcesterma.gov/uploads/88/76/8876150daa6d86a6ac9bfd6b93b7ddf3/health-of-worcester-report.pdf

Obesity rates have increased in the city in the past decade; however, what are more alarming nowadays are the increasing rates among school children. Roughly 40% of the children from grades 1 to 11 are either overweight or obese (WFALPC, 2012). Figure 10 shows the percentages of obesity rates in public schools with respect to race and grade.
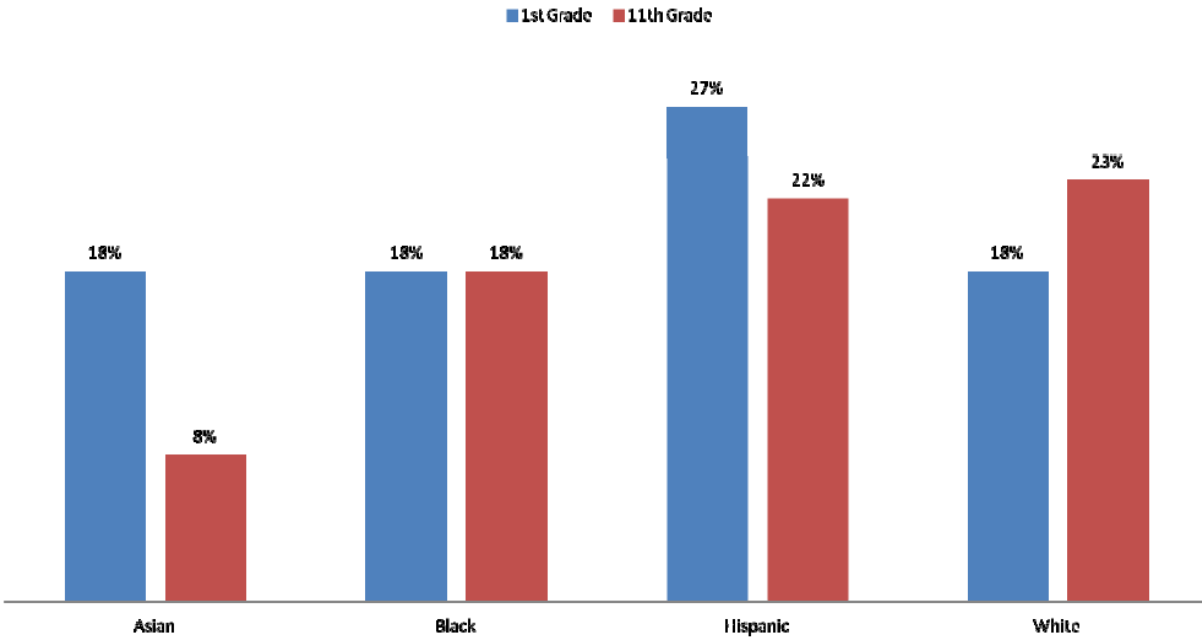
Figure 10: Obesity in Worcester public schools by race and grade, 2011
http://www.worcesterma.gov/uploads/88/76/8876150daa6d86a6ac9bfd6b93b7ddf3/health-of-worcester-report.pdf

This data and rising obesity rates has starting pushing some public organizations, such as the WFALPC to develop initiatives that will prevent these rates from increasing and that will make Worcester a healthier city.

2.3 Obesity is a Multidimensional Issue

Obesity is a complex and multidimensional problem; it is an issue that encompasses genetic, environmental, and social factors. Genetic factors may refer to a hormonal imbalance, specifically the leptin and ghrelin enzymes, which affect satiety and hunger levels and this makes an individual prone to gain weight (Vendrell et al., 2004).

As Lee points out: "Much is still unknown about why childhood obesity prevalence has risen so markedly, but it is clear that shifting social and environmental contexts play a role" (Lee, 2012). Environmental factors are those regarding the physical space surrounding individuals and the community. For example, the proximity to fast food restaurants and corners stores to schools may enhance access to high caloric, low nutritious foods and lead to unhealthy diets (Day & Pierce, 2011).   The social factors refer to the relationships between the individual and his or her family, friends, school and the community, and analyze how these different dimensions affect the individual's food choice. In the following sections will consider how these factors influence food choices, especially for teenagers.

2.4 Environmental Factors

Environmental influences on overweight and obesity are primarily related to food intake and physical activity behaviors. In addition, aggressive and sophisticated food marketing in the mass media, supermarkets, and restaurants, and the large portions of food served outside the home, promote high calorie consumption (Pi-Sunyer et al., 1998). The environmental factors that will be discussed in this section will be neighborhood foodscapes, food availability around schools and food convenience.

Evaluating Foodscapes

There have been several other studies throughout the United States that have used geographic information systems (GIS), a spatial modeling and analysis software, to get information about a community's foodscape, which we define as "food outlets in a neighborhood that sell or donate food to the public". One study in Minnesota used GIS and telephone surveys to see if living or working near fast food outlets was linked to obesity (Jeffery, 2006). The telephone survey was given out to 1,033 Minnesota residents. The survey collected the persons weight, height, how

frequently they ate at fast food outlets and their home and work address. GIS was used to determine the proximity of the interviewees to fast food outlets. In the end, there was no correlation between how close someone lived or worked to a fast food outlet and obesity or frequency of eating there.

Another study in California found a link between fast food outlet proximity to high schools with high obesity rates (Nixon, 2011). This study used GIS to create ¼ mile and ½ mile radii around the schools in Santa Clara County and observed the proximity of fast food outlets to the schools. These two studies show that there can be conflicting conclusions between studies that were ultimately trying to find the same information about an area. Fast food proximity to a person's home, work or school will not always lead to obesity because the study in Minnesota proved that there was no correlation between proximity and obesity.

Not all GIS food studies tried to find links between fast food proximity and obesity. One study in New York found that areas of different ethnic groups and income had vastly different foodscapes (Gordon, 2011). Low-income areas that were primarily populated by African Americans had many fast food outlets and a low access to healthy foods, such as supermarkets, in their area. Hispanic neighborhoods had high amounts of fast food outlets similar to African American areas, but the Latin areas had a slightly higher access to healthier food options compared to the African American areas. The areas mostly populated by whites were the complete opposite; they had less fast food outlets and higher access to healthier foods than both the African American and Latin based areas (Gordon, 2011). A study done in Worcester that looked at the Worcester food security had similar results. That project also found that predominantly white neighborhoods had a higher access to healthy foods compared to areas of other races and ethnicities (Allen, et al, 2012).

Food availability around schools
Student food options around schools influence their snacking behavior. For example, according to Neckerman food outlets near New York City schools offer inexpensive, energy-dense foods for consumptions (Neckerman, 2012). If a student wishes to purchase a snack or lunch near their school, their healthy options are very limited. Lee shows that students neighborhood with better access to major super markets and grocery stores have lower obesity rates (Lee, 2012).

Urban schools are more likely to have fast-food restaurants nearby. In a national study, 67.5% of secondary schools in large cities had a fast-food restaurant within about 800 meters (Neckerman, 2010). With proximity, convenience, and inexpensive options that fast food restaurants offer, they attract a lot of students who are looking for those types of options.

Small grocery stores and other food services such as corner stores are also big sources of unhealthy food. The student's food options around their school are unlikely to offer healthy cheap options. The student is forced to pick the unhealthier option by sheer availability. For example, in New York City, Healthy Corner Store initiatives have been created to counter-act this very problem. Government agencies and community organizations have been able to support local food retailers that are willing to sell healthy foods (Sandoval, 2013).

Food outlets are more prevalent near schools in areas with higher levels of urbanization and commercial land use (Neckerman, 2010). Low-income and Hispanic students have the highest level of exposure to inexpensive unhealthy food as shown in this 2010 study done in New York City showing the food options around a typical school (Neckerman, 2010). The average school in New York City had about 10 corner or small grocery stores within 400 meters. The lack of fresh, healthy foods limits the student's options and highly contributes to their unhealthy food choices (Neckerman, 2010).

Convenience Food

Fast food restaurants have taken advantage of the changes in household dynamics since the 1970s. Many households are becoming more single parent or duel working parent households, leading to less parent involvement in the child's life and less time for cooking (Gable, 2000). They advertise convenient "food" which enables working parents to make sure their children have something to eat. Over the last few decades, more children are prone to eat pre-prepared, microwavable food instead of a healthy, fresh meal when both of their parents are working (Sokol, 2000). In addition, studies have shown children tend to buy high caloric snacks when their parents are not around (Tucker, 2012). Parental work hours impact the quality and quantity of time that they spend with their children. Their work schedules are a definite factor in the child's health and should be taken into consideration when discussing their behaviors (Benson & Mokhtari, 2011).

Time and convenience are among the biggest factors in adolescent food choices. Food is more tempting if is easily available. As a result, quick foods are a common choice. In general, healthy foods like fruits and vegetables are not conveniently available while snacks and candies are available (Nuemark-Sztainer, 1999). Convenience and time influence what adolescents choose to eat.

2.5 Social Factors

Parental Influence
Several social factors contribute to the food choices of high school students. Parental behaviors contribute largely to children's food choices. Parents with low income cannot afford the healthiest choices for their children and therefore tend to buy the less expensive, high caloric food (Gable, 2000). Low-income households between 1977–1978 and 1987–1988 reduced their vegetable consumption by 22%, as compared to higher income households, which reduced it only by 12% (Gable, 2000). This suggests that higher income households are more likely to buy healthier foods and therefore create healthier food choices for their children.

Studies have shown that parenting style effects how adolescents develop their eating habits. For example, parents who maintain too much control over their young child's food choices can in turn lead to adolescents who are not able to make healthy food choices for themselves (Gable, 2000). Studies suggest that too much control over a child's intake of food is critical, but so is an under controlling attitude in a child's diet (Gable, 2000). A parent's under involvement could also lead to poor decisions made by the child, which could lead to health problems in the future (Gable, 2000). Children must learn the importance of healthy food choices and recognize their bodies' sign of hunger in order to maintain a healthy food lifestyle.

Data also shows that parents' level of knowledge about their child's nutrition contributes to their food options. Parents who know more about nutrition are more likely to provide healthy choices to their children (Gable, 2000). Basic knowledge of the healthy and unhealthy nature of certain foods can allow parents to make proper choices in their food selections for their children.

Adolescent self-perception
Researchers have shown that adolescent body image can be related to dysfunctional eating (Davison, 2006). Resnick argues that adolescents lack a sense of urgency concerning their future

health and therefore overlook ideas such as good nutrition and healthy eating (Resnick, 1986). According to a study conducted by a group of researchers at the University of Minnesota, body image is a social concern that can affect food choice in adolescents. Twenty-one focus groups were led in which 141 adolescents in 7th and 10th grade participated. From these focus groups, it was gathered that becoming taller and stronger is important to men while losing or gaining weight is significant to woman. Food choice can play a factor in body appearance and lead to ideas about body image. Adolescents may base their food choices on the predicted body image that it will produce (Neumark-Stainzer, 1999).

In addition, body image perceptions of individuals vary among the different ethnic and racial groups. Differences in body image and weight-related concerns between African American and Caucasian girls and women have been observed (Pi-Sunyer et al., 1998). In general, African American girls and women report less social pressure to be slim, fewer incidences of weight-related discrimination, less weight and body dissatisfaction, and greater acceptance of overweight than their Caucasian counterparts. College-age African American women report less concern and fear about fatness, less drive to be thin and less concern about dieting than do college-age Caucasian women. In addition, African American women may ascribe some positive qualities to being large, such as having stamina, strength, and solidity, and are less likely to link body size to health than Caucasian women. African American elementary school and high school girls were more likely to be trying to gain weight and less likely to be trying to lose weight as compared to Caucasian girls. Because of the above, it is possible that weight control initiatives may elicit different reactions from African American and Caucasian women. Less is known about the relationship between obesity and body image disturbance in other racial and ethnic groups (Pi-Sunyer et al., 1998).

Appeal, Advertisement and the Addictive Nature of Junk Foods

The appearance of food plays into the psychology behind adolescent food choices (Neumark-Sztainer, 1999). The appearance of an item is imperative to its sale or lack thereof. A striking example of this is presented in the color of the soda Dr. Pepper. The company that sells this product found that even making the color of the beverage a slightly lighter brown led to more sales (Moss, 2013).

Figure 11: Dr. Pepper bottles

http://www.drpeppersnapplegroup.com/smedia/www/2012/08/24/img-dr-pepper-family_12133093171.jpg

This shows how much of an affect that presentation can have on people. A lot of the time big companies try to appeal to their customers by playing to certain age categories. Appearance can be a making or breaking point in the sales of products (Moss, 2013).

Not only are companies playing into the psychology of food but they are also using science and human physiology to create addiction. The food industry has been compared to the tobacco industry for advertising harmful items to children and making them addicted (Moss, 2013). Some foods can be detrimental by causing diseases like obesity, high blood pressure or diabetes. Food can have an addicting nature just like cigarettes and lead to life altering health issues (Moss, 2013). Companies have hired chemists and other professionals in order to create foods that produce a "bliss point" in consumers. The bliss point is the level at which the person craves the food the most but without feeling sated. To reach this point, companies have produced unhealthy, high caloric foods that consumers continue to buy. While this has a detrimental effect on the consumer, the company thrives. The tobacco companies have received heavy criticism for advertising addictive substances to teenagers and the food industry is now participating in similar activities (Moss, 2013).

Advertisement is another aspect of food companies that have targeted children and adolescents. Adolescents and children view over 3000 ads a day through mediums such as television, Internet, magazines and billboards. Companies use techniques such as placing products in popular movies or using celebrity endorsement to promote their items (Committee on Communications, 2006). Companies have actively made advertisements targeting children and teens even with the risks associated with the foods. Many of the advertisements that adolescents watch can be found on the television. It has been studied that the more television ad watching an adolescent does, the more likely they are to eat fast food and food that is more sugary. There is a positive link among ad exposure and food choices (Scully, 2012). Ads do not generally promote healthy foods. Instead they show meal deals, which include unhealthy foods and beverages like soda and also make fast food items look good by enlarging their appearance. Advertisements play largely into

psychology and although they can be deceiving, they also have the power of being convincing (Neumark-Sztainer, 1999). An example of this is shown through "Lunchables" ads, which started to appeal to independence of adolescents. Adolescents want to assert their independence. "Lunchables" ads play into this by allowing children to have control and power in creating their own lunch by providing them they ingredients such as ham and cheese slices and crackers to make their own sandwiches (Moss, 2013).

3.0 METHODOLOGY

The goal of the Worcester Foodscape project was to understand what influences adolescent food choices. To give voice to the high school students[1] we worked with, we used food diaries, advertisement diaries and focus groups. To understand the impact of the Worcester foodscape on their food choices, particularly their after school eating behavior, we mapped food retail outlets in relation to schools and school bus stops. The following is a list of objectives that helped us accomplish the main goal of this project:

1. Create a better understanding of high school students daily food choices
2. Explore the influences of advertisements in student's everyday life
3. Identify the social meanings of food to adolescents
4. Identify and map the concentration of food retail outlets within a half-mile radius of Worcester high schools, middle schools, and bus stops.

3.1 Understanding student food choices

The participants received journals that were used as food diaries for a period of one week. The Keystone group members wrote down the different meals they ate throughout a typical day. They also included where they got that meal and who participated in the meal. This gave an insight into the typical food choices and food access that the Keystone group is exposed to on a daily basis. These food diaries also described who is involved in the preparation of the student's meals.

The questions that the students filled out in the journals were the following:

- "Describe your daily food intake including beverages (breakfast, lunch, dinner and snacks)"
- "Who do you eat with?" which was listed in a column next to each food item

After a week, these journals were collected and a focus group followed to discuss the results. Refer to Section 3.2 to see the detailed questions asked.

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[1] The Keystone Group is a leadership group of the Boys and Girls Club that consists of teenagers within the ages 13-18. Nine members of this group participated in our focus groups and food and advertisements journals; they were all females.

While advertisements about fast food are ubiquitous, people are not aware of the amount of advertisements they are exposed to on a daily basis. To help the Keystone Group students assess the impact of advertising, we gave them advertisement journals.

The specifications for the advertisement journals are as follows:

- o A set of questions asked them to rate advertisements based on influence on a scale from 1-5, 5 being the most influential (made them want to eat there) and 1 being no influential at all.
- o They were given options as to why they think was influential. These options included cost (such as 2 for $5 deals), a new product, and presentation of the food or proximity of the fast food franchise.
- o Space was provided where they noted which restaurant was being advertised.
- o They were also given choices about where they saw the advertisement which included television, billboard, posters, newspaper, magazine or website.
- o When feasible, students were asked to take pictures of the advertisements they saw, e.g. corner stores, billboards, bus stops and mark their location (i.e., near their house, near school, near Boys and Girls club and other)

3.2 Exploring the social meaning of food to adolescents

Advertisements and daily food choices are prevalent and it is essential to be able to interpret them in order to make healthy food decisions. After collecting data with the Boy's and Girl's club about the advertisements and foods that they encounter, the data was analyzed. Methods of analysis included creating charts and organizing information into categories. The factors that advertisements are targeting were studied, such as if they focus on price, taste, convenience or other influences. Daily food intake and the meaning behind food were also studied. Five focus groups were conducted so that information that the students have gathered can be organized and analyzed. The first four focus groups were conducted at the Boys and Girls Club of Worcester and the final focus group took place at Worcester Polytechnic Institute. These focus groups included asking students about their specific daily meals, the advertisements and fast food chains and corner stores around their schools, and what issues they believe exist in their community relating to food. This information was used to create a video presentation that described the

issues that cause advertisements to be persuasive and their perception of the meaning behind food.

Focus groups

The first focus group was used to obtain the students perspective on the cause of obesity.

Questions:

Do you think obesity poses a problem in your community? Why or why not?
What do you think is the cause of obesity among the young?
Do advertisements from fast food outlets make you want to purchase their food?
How do the restaurants around your school and in your neighborhood affect your food choice?
Tell us what and where you eat in a typical day, from when you get up to when you go to bed.
What have you learned about health and nutrition in your school? Has it had a significant impact in your lifestyle? Why or why not?
Have you been exposed to other programs or nutrition education outside of school, for example family members or friends?
How does peer pressure influence your food choice?

The second focus group was used to collect food diary journals, talk about the results and what the participants learned. It was also be used to introduce advertisement journals.

Questions:

Did you notice any patterns in your food diaries?
How healthy do you think you eat in a typical week?
What kind of snacks did you choose to eat?
Did writing out your meals influence your choice in the food you ate?
Did taking notice of your diet influence you to alter your food choices?

The third focus group was to gain more detail about food choice and the social perceptions of food.

Questions:

Where do you get the snacks that you consume?
When you buy snacks, is it because you are hungry or for other reasons?
Is there a specific reason for going too fast food restaurants? (Taste, price, convenience, friends)
What is the most important meal of the day and why?
Do you think it is important to eat all three meals a day?
Looking at your journals, which meal that you ate did you think was the healthiest? The unhealthiest?
Why do you choose the food you eat?
Do you think you are independent in your food choices?
What would you choose to eat if you weren't provided food by the school/parents?
Do you see eating as social activity or just as an activity that is necessary?
Do you and your parents like the same kinds of food?
If you had to cook a meal for your favorite celebrity, what would you cook?
What would you consider to be the healthiest place to get food around your school?
What foods are considered "cool" to eat? "Uncool" to eat?
Do you feel safe walking to the stores around your school?

The fourth focus group was used to discuss advertisement

Questions:

What ad do you remember the most and why?
Where did you find most advertisements to be? (TV, billboards, internet)
What company did you notice advertise the most? (McDonalds, Subway, Burger King)
Which advertisements were the most compelling to you?
Which ad made you want to eat there the most?
Did you ever end up buying an item at the advertised company?
Were there trends in the ads? Did most of them mention cost or taste?
Were the advertisements located near your schools?
If you were to create an advertisement, what would you put on it to compel people?

The fifth focus group was a summation of the most important questions that encompassed the entire project.

Questions:

Overview

During a typical day what do you eat, start with breakfast and go through the day?
When are you most hungry?
What do you do when you're hungry?
Do you eat three meals a day?

Food and Identity

- If you were a food, what would you be and why?
- If you could eat anything what would it be and why?
- Describe your most memorable meal?
- What do you think about when you hear someone say you should eat healthy, nutritious food?
- Why do you eat what you eat?
- Why do you eat at fast food restaurants?
- Do you take pride in your food choices?
- If your parents make you eat a food, do you not want to eat it?
- When you see someone eating a snack does it make you want to eat snack? Even you're full?

Environmental influences

- If you go to corner stores after school, what do you buy and why do you buy it?
- What's the most fun thing about eating in a fast food restaurant?
- How does advertising affect what you eat?
- Do you go to corner stores alone to get snacks even if the area is unsafe to walk in?
- Are there any healthy places to eat around your school?
- Are there corner stores near your school/the club?
- Where do you get your snacks?

3.3 Analyzing the Worcester Foodscape

This project utilized the program ArcMap Version 10 to create Geographic Information System (GIS) maps of Worcester's foodscape. The maps contained locations of the food outlets in Worcester such as fast food outlets, corner stores and gas stations along with the locations of Worcester high schools, middle schools, and high school bus stops. The goal of the map was to analyze the proximity of the food outlets to the Worcester schools and bus stops. The information was displayed on the GIS map as point data and layers.

The majority of the layers that are on the GIS maps were acquired from the MassGIS website. That is where the layer files for schools, roads, and city borders were obtained. The information on that website was for all of Massachusetts so the layers had to be edited because only the Worcester information was needed. Originally, the project was also going to include information about cities that border Worcester, but due to time constraints, Worcester was the only focus.

The layer for the food outlets was obtained from a past IQP project that was done on Worcester food security. On the original layer there were data points for fast food outlets, corner stores, gas stations, pharmacies, malls, and supermarkets but also several points, such as churches and hospitals, which were not needed for this project. In the end, the points for fast food outlets, corner stores, and gas stations with food courts, pharmacies, malls, and supermarkets were kept, using Google Maps to double check to see if the points on the original file were still valid. Any new businesses that were not in the file were also added. The point data for fast food, corner stores, and gas stations with food courts, pharmacies, malls and supermarkets were all given their own icon and color on the GIS map so that it was easy to tell which point corresponded to what type of business. Fast food outlets, corner stores, and gas stations with food courts were chosen to be the main types of food outlets.

The schools that were on the original layer from MassGIS were split into school type such as Public, Private, Charter and a few others but those were changed to be organized by grade level, Elementary, Middle School and High School. In the end, the following schools were mapped out:

High Schools	Middle Schools
Burncoat High	Burncoat Middle
Claremont	East
Doherty	Forest Grove
Holy Name	Sullivan
North	
Notre Dame Academy	
South	
St. Mary's	
St. Peter Marian	
University Park Campus	
Worcester Academy	

Elementary schools were left out because those schools do not contain the age group that was focused on for the project. The schools were also given their own icon and color in order to tell the difference between grade levels.

 For the bus stops, that information was obtained by the Worcester Public School website. The group decided to map out only the high school bus stops because that was the age group that this project focused on. Using Google Maps and the bus stop street intersections, each of the bus stops was given a point on the GIS map and those points were put together to make a bus stop layer.   The bus stop layer contains all of the departure bus stops for Burncoat high, Claremont, Doherty, North, South, and Worcester Technical.

 A half mile radius was chosen to be put around the schools to see if there was any clustering of food outlets near schools. This was done by creating a half mile shaded circle, or buffer, around the high schools and middle school. The same was done for bus stops but instead of a half mile, a quarter mile radius was put around all the bus stop points. The quarter mile and half mile radii were chosen because those values correspond to about a 5 to 10 minute walking distance.

4.0 FINDINGS

4. 1 Introduction

This chapter provides the major findings of the study from our spatial analysis of the foodscape around schools as well as a qualitative analysis, based on focus groups, in-depth interviews and food journals of adolescents' food choices. The seven participants in our study were part of the Keystone group, and they ranged between the ages of 14-17 years. The participants came from either a Black or Hispanic background and all of them were females. Participation in the focus group was not constant; different students participated in each focus group. While some participants partook in all focus groups, others only contributed to one.

4.2 Food Choices

Social Factors

Research shows that obesity is a prominent issue in the Worcester schools; however, after speaking with the Keystone Group at the Boys and Girls Club, we discovered that they were under a different impression. Instead, the students provided us with information on food choices and the social meaning of food. Many of the students found body image and social pressures to be more relevant to their experience than obesity. The group composed of all girls commented that often times girls would give away their school lunches to boys. This was because girls were focused on staying thin while boys who were sometimes athletes would intake more food to stay in shape.

Another social aspect relating to food was in the stereotype of which foods were cool or uncool. The students described that fast food like McDonalds and pizzas are cool foods to eat while foods like salad are uncool to eat. When ask what a cool food to eat was, one member states "McDonald's" while another exclaims "pizza"! Social pressures like what one looks likes or what is perceived to be popular, influence adolescent's food choices. Although obesity was the original supposed issue, it became apparent that reasons behind food choices were more prevalent when speaking with the Keystone Group.

Influence of Schedules

We discovered that many of the students did not eat three meals a day. The students told us that on a typical school day, they would sometimes eat breakfast and lunch but often times skip dinner. When asked why they would skip dinner, they stated, "We usually have dance practice and when we get home we aren't hungry anymore." When asked what the most important meal of the day they told us that it was, breakfast, however many students claimed that they did not eat breakfast because of lack of time. Some students mentioned how their morning schedule involved "rushing" to the bus to be able to get to school on time. Another student comments, "Usually I only eat maybe two meals a day. I either skip breakfast and eat lunch and dinner or I eat dinner and skip breakfast and lunch." Several of the other students agreed with this statement. On the other hand, on a typical day off from school, the students would eat significantly more due to less time constraint and a better selection of food at their homes. One student states, "When we are at home, we have time to eat." The students have busy schedules because of their various commitments in a typical day. The students not only have to finish their homework, but they are also part of the Boys and Girls Club dance team that practices every Monday, Wednesday, and Friday. In addition to that, the students also must complete their jobs at the Boys and Girls Club as some of them work in the "Kid's Café" or watch after some of the younger members. The average time spent at the Boys and Girls Club for them is usually between the hours of 4pm-8pm every day.

The Keystone Group discussed the cooking dynamic in their households. When on a busy day for the students, their parent's will either leave them cooked food for dinner of they will make their own dinner and eat by themselves. The students are busiest during school days. They tend to eat alone on school days because of their hectic schedules. After school ends around 2pm, they will go home, have a quick lunch and then head over to the Boys and Girls Club. They will then either have dinner there or at home after dance practice.

Food Choices Outside the Home

The adolescents in the Keystone group spend a large amount of time at school during the week. Their food choices at school are different from those at home. Many of the students mentioned the cafeteria food at their school. The Worcester Public School's webpage contains menus of what is being served for each month. The most common items are chicken, pizza and pastas. It does not appear that there are a great variety of choices and there is quite a bit of repetition. The

prices of breakfast and lunch are also listed on the website with breakfast costing 20 cents and lunch costing $1.50. There is also a reduced rate where breakfast costs 15 cents and lunch is 40 cents. While the school does provide these options with relatively low prices compared to other restaurants and snacks, it was found that most of the Keystone group does not eat at school. Instead they wait until they get home to eat and they had several reasons for this. Some of them will skip school breakfast or lunch because they just have no desire to eat what the school serves. One of the girls commented about breakfast "The breakfast that they have at school is not satisfying enough." When they do in fact buy food at the school, they won't eat much of it because they believe the quality is low. All of them believed that the food offered at school is unappetizing. One-student states, "If you are lucky, you get the real cheerios, not those fake little bunnies in the bag. They taste like powder." The students eat because they are hungry but do not like the taste of the food. Sometimes, due to the dissatisfaction of the school food, they skip meals entirely. There is an option of bringing your own meal, but many of the students commented that they don't have time to make meals before school starts so end up eating food at school or skipping meals. Several of them will skip breakfast and have dinner and lunch. In contrast, some will skip dinner and have only breakfast and lunch; therefore, having only two meals during a school day was a very apparent pattern within the Keystone group.

Family also Plays a Role

When it is not a busy day for the family, they tend to eat dinner together and will eat whatever the parent decides to cook. There was no pattern as to which parent will cook dinner as cooking duties will switch between the mother and father. Some of the students from the Keystone group talked about the differences in their parents' tastes and their own. Many of their parents prefer ethnic meals that usually involve very similar ingredients, (i.e., chicken, rice and beans tend to be in almost every meal their parents cook for them). Many of them talked about how they will refuse to eat what their parents decide to make them because they prefer to have a more variety in what they eat. They become exhausted by the same types of food every night and will request something different or not eat at all. One girl states, "I just refuse to eat what my mom gives me and will snack later when I get hungry." When they are not cooking their own food, they will suggest items that their parents could cook but the decision to cook the suggested food is on the parents.

Many students do not feel like their food choices are their own when eating at home. The students eat what their parents give them. One-student comments, "I just eat what is cooked that week." Although they do not feel like their choices are independent, food is a large part of their familial and cultural identity. Many of the students mentioned their ethnicity when speaking about what kind of foods their parents made for them and seemed to take pride in this. They enjoyed introducing each other to their ethnicity's food and thought it was cool to eat it.

To many students, food has a way of bringing their families together. When asked their most memorable meal, all students stated that their meal in some way brought their family together. They do not generally eat together as a family so when they do it is remarkable. "My most memorable meal would be with my family when we went to a Chinese buffet. We don't eat together a lot. We usually go separate ways in the house but that was like a moment that I wouldn't forget because there was a lot of joy and happiness and everyone got along." Many of the girls agreed with this statement, which shows how powerful food can be in maintaining family connections.

Snacking

The students told us where they got their snacks, how they viewed snacking and what compels them to eat snacks. The parents of the students generally bought snacks from places like Walmart, Price Right and Target while the students bought themselves snacks from corner stores. There is a corner store located within a five-minute walk of the Boys and Girls club where the students purchase items like Arizona Ice Teas, pastries, chips and other snacks. They mentioned that convenience played a large role in their decision to go to the corner stores. They were also intrigued by the idea of a cheap, quick snack and were even willing to travel through a dangerous neighborhood by themselves to get a snack. While some students said that there were corner stores near their schools, they generally did not go to them because they are not allowed to leave school during the day. The students are typically free after school and walk to corner stores but are not free before school to go to corner stores because of time constraints. Many of them will travel to their local corner store and purchase drinks, chips, candy, or other foods that are both portable and quick to eat. One girl states, "When I go to the corner store I usually get an Arizona and a bag of chips and sometimes a brownie or something like that and maybe sometimes some candy too." These choices come from several factors. They choose to eat that

food because it is convenient to get, cheap, quick, and portable. That means they are able to access it easily, they can afford it, and they can eat it quickly.

The reasons as to why the keystone group will frequent fast food restaurants are similar to those about purchasing snacks. Many of them see it as a convenient, cheap, and quick place to get a meal. While referencing McDonalds, one-student states, "I just really go for like sometimes maybe the convenience like I haven't eaten much all day and I need something to eat". Many of them go there socially with either their friends or family. Family dinners can be had at these restaurants if the family wishes to still have a family dinner but does not have time to cook.

The students did not view snacking as a health concern or worry too much about the caloric impact. Almost all of the students whom we talked to are on the dance team at the Boys and Girls club. When asked if they were concerned about consuming calories, one student stated "Calories mean nothing when we are at the club because we know that a couple hours later we're going to go burn it off during practice so it doesn't really matter." Their level of physical activity impacts their attitude towards the health consequences behind snacking. Even after asking further, they said they would still consume the snacks they do regardless of if they were on the team or not. This indicates that the students might be apathetic about the healthiness of the food they consume.

Several of the students discussed the psychological reasons behind consuming snack foods. They commented that when they see a snack, they would eat it even when they are full just because it looks good. If they see someone else eating, they want to eat too regardless of their hunger level. One student states, "When I see it there, I'll eat it." Another student noted, "Sometimes, I feel like it's just my mind telling me. Like if I came from home and just ate rice and beans and then I come here (the Boys and Girls club) and I see someone like eating chips or pizza for some reason I want to eat that but I really don't but my mind tells me I want it and my stomach is saying no, no." This is a powerful statement that details the psychological power that can contribute to eating. Many of the students agreed that their perception that something would taste good was more convincing than a full stomach and would lead to overeating.

Overall the students were very enthusiastic about food and openly discussed their decisions. It is a big part of their life and something they could easily talk about. Food seemed to be not only an

essentiality but also a cultural, familial and social aspect of their lives. One student summed up this sentiment with the words "I get so excited just to eat."

Advertisements

The social factors previously discussed also act hand in hand with environmental factors such as advertisements and proximity of fast food outlets and corner stores when influencing adolescents' food choices.   Advertisements are ubiquitous; they are in billboards in busy streets, posters on schools, in popular websites, and on the television. These last two are arguably the ones where adolescents are most targeted, especially since over the past few decades, there has been a decrease in physical activity due to an increase in sedentary behaviors (Cavadini, Siega-Riz, Popkin, 2000). This is due to the increasing technology that provides TV shows and webpages, such as YouTube and other social media outlets, which many teenagers describe as "cool". Several of the Keystone members mentioned how commercials are tempting and make them want to eat fast food, however, they said often times they are disappointed by what they get: "I wish they [these advertisements] were real…they make it [the food] look so nice and then you get the real product and it's junk." The group agreed that the most influential ads are those that enhance the appearance of the food by "making the portions bigger" and those that offer a good price deal. A member even mentioned "When a new product comes out, I just want to try it right away" showing how effective this selling tool is on teenagers.

Curiously, they are aware that many fast food outlets are not healthy due to the high content of fat, sugar, and salt.   A girl even pointed out the "lethargic feel" after eating McDonald's for example.   Despite this, the advertisements by this popular fast food outlet, according to the participants, always make the food look appetizing and they are tempted to eat it. This finding correlates to several studies that have studied the influence of advertisements on teenagers' food choice, especially how advertisements use color and enlarged portions to make fast food look great (Neumark-Sztainer,1999), making the teenagers forget about the low nutritious content. When the participants were asked what would make the advertisements more appealing to their parents, they mentioned how low prices and deals are what would influence their parents the most when buying fast food. In contrast, the students typically focused more on the food's appearance.

The availability and proximity of corner stores also has an influence on the teenagers' food choice. Some of them mention how they visit corner stores on a daily basis; however, one participant stated "If I take more cash than I intended to spend originally, I will buy more snacks." This shows how the placement of snacks and cheap food in corner stores plays a big role in a higher consumption of unhealthy food.

4.3 Evaluating the School Foodscape

In order to relate the findings on food choices of the Keystone group with the Worcester foodscape, we first used the GIS software ArcMap version 10 to map the location of high schools, middle schools and elementary schools within the city. We then mapped various food outlets such as fast food, corner stores, pharmacies, gas stations, and malls. A GIS map containing the departure bus stops for Worcester high schools was also created in order to analyze the proximity of food outlets to the bus stops. Although all of these points were put on the map, the proximity of fast food outlets, corner stores and gas stations around high schools, middle schools and departure bus stops was the main focus of the project. The following are the schools that are displayed on the GIS map:

High Schools	Middle Schools
Burncoat High	Burncoat Middle
Claremont	East
Doherty	Forest Grove
Holy Name	Sullivan
North	
Notre Dame Academy	
South	
St. Mary's	
St. Peter Marian	
University Park Campus	
Worcester Academy	

The goal of our spatial analysis was to see if food outlets clustered near schools and bus stops. Clustering was defined by determining the percentage of food outlets around the schools and bus stops within the determined radii. Half a mile was the determined radius for middle schools and high schools, while a quarter mile radius was used for the bus stops.

Figures 12, 13, and 14 show the proximity of the different fast food outlets, corner stores, and gas stations, respectively, to high schools. A study in California (Davis, et al., 2009) showed that fast food outlets cluster around high schools. In contrast to this study, figure 11 shows that these outlets are located on the two main streets in Worcester (Main Street and Park Avenue). However, these are also the streets through which the students drive by to and back from school on a daily basis. Therefore, it stills provides an influence on the students' appetite for a quick meal and even to the parents for convenience. A participant in one of the focus groups mentioned the "lane of restaurants near their school", indicating how the sole visibility of a food outlet can affect food choice.

In addition, the maps show that these outlets are not equally distributed in the city. For example, figure 12-14 shows that a significant portion of these food outlets (fast food, corner stores, and gas stations with food courts) are clustered around Providence Street, Vernon Street, Millbury Street, Main Street, and Park Avenue. The high schools that seem most affected by this proximity are Claremont, University Park Campus, Worcester Academy, and St. Mary's.
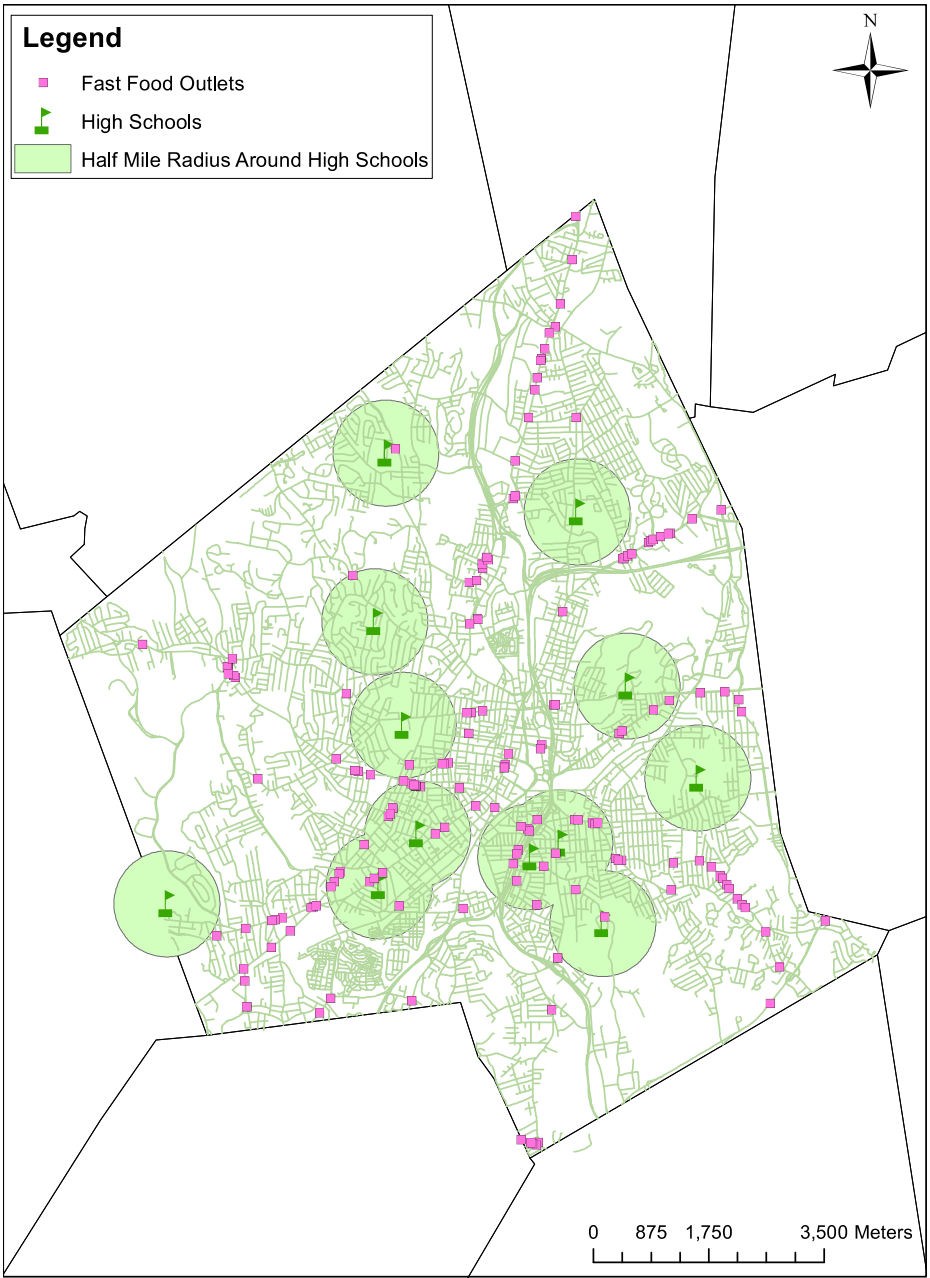
Figure 12: Proximity of fast food outlets to Worcester high schools

Figure 13 shows the proximity of corner stores to high schools. They are not as numerous as the fast food outlets, however, the majority of them are located on the same streets mentioned before, also affecting the same schools.
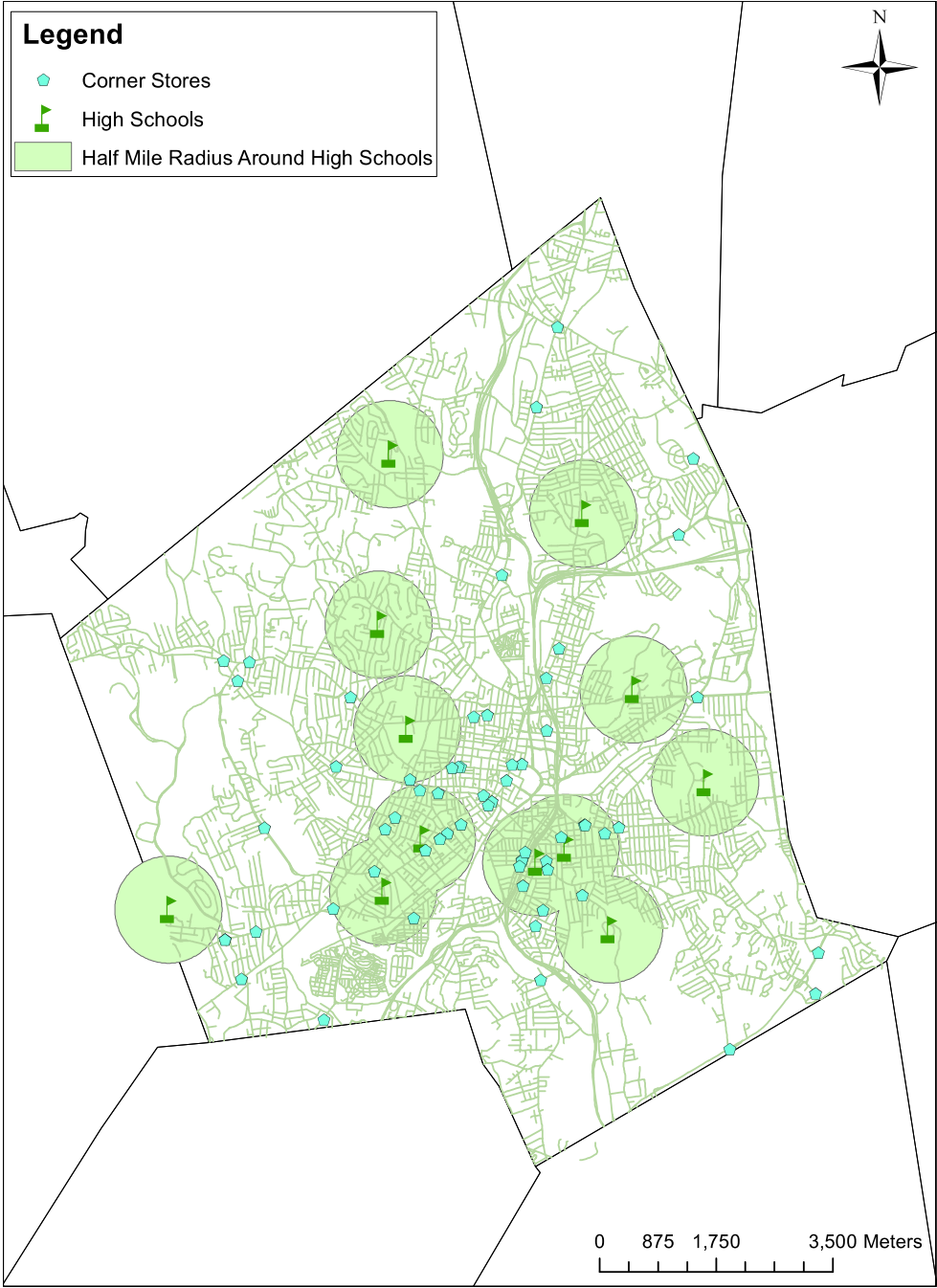

Figure 13: Proximity of Corner Stores to Worcester high schools

Figure 14 shows the gas stations in the city with respect to the high schools. Gas stations were mapped out because the majority of them supply snacks and drinks to the public. They are present in the least amount in comparison to fast food outlets and corner stores. However, they are mainly situated on the same streets, just like the other two food outlets.
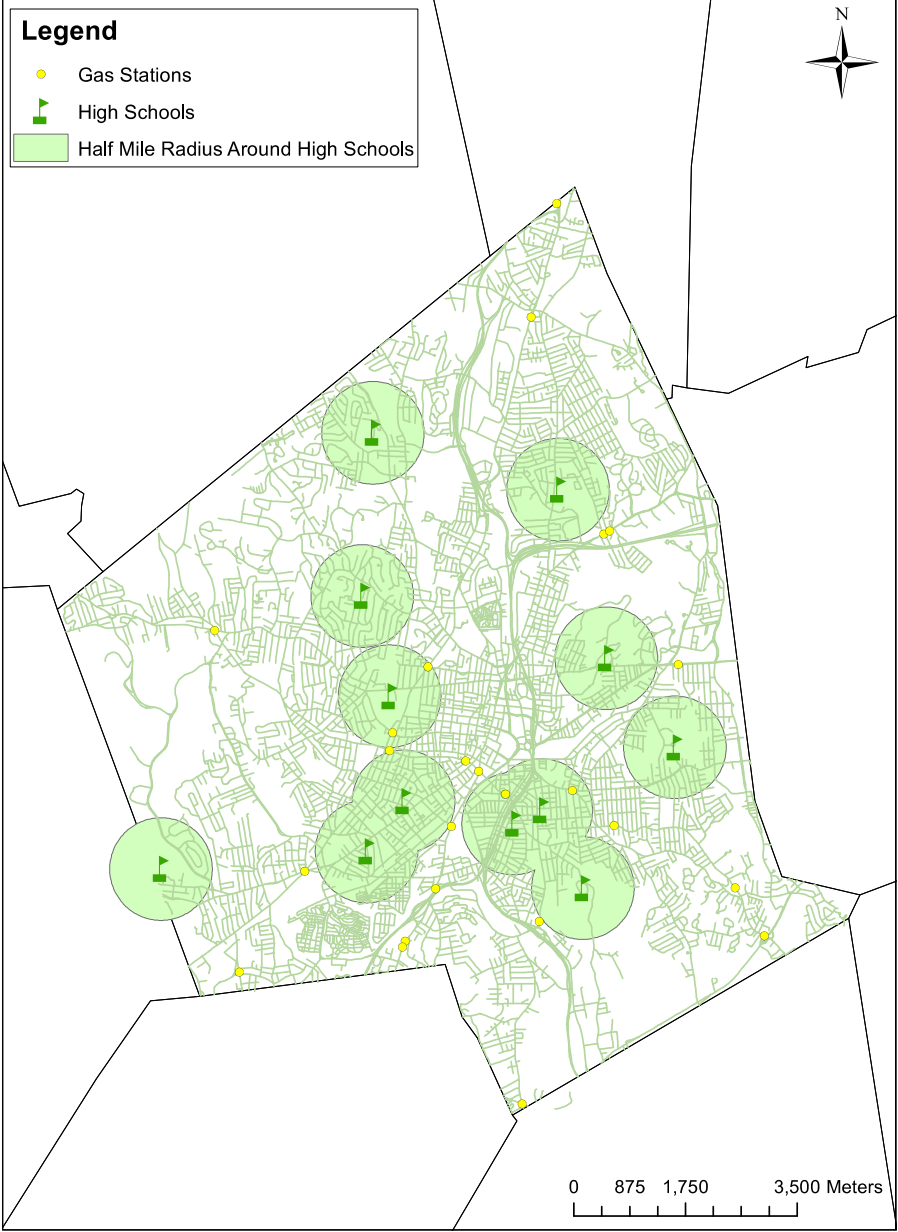

Figure 14: Proximity of gas stations to Worcester high schools

Figures 15, 16, and 17, like Figures 12, 13, and 14, show the proximity of the different fast food outlets, corner stores, and gas stations with food courts, respectively, to middle schools in Worcester. Similar to the high schools, there is no significant clustering around the middle schools because the outlets are situated in the main roads, however, East Middle, located on Grafton Street, and exhibited the most clustering of the three types of outlets. Forest Grove, located near Park Avenue and West Boylston Street, experienced fast food clustering along with East Middle.
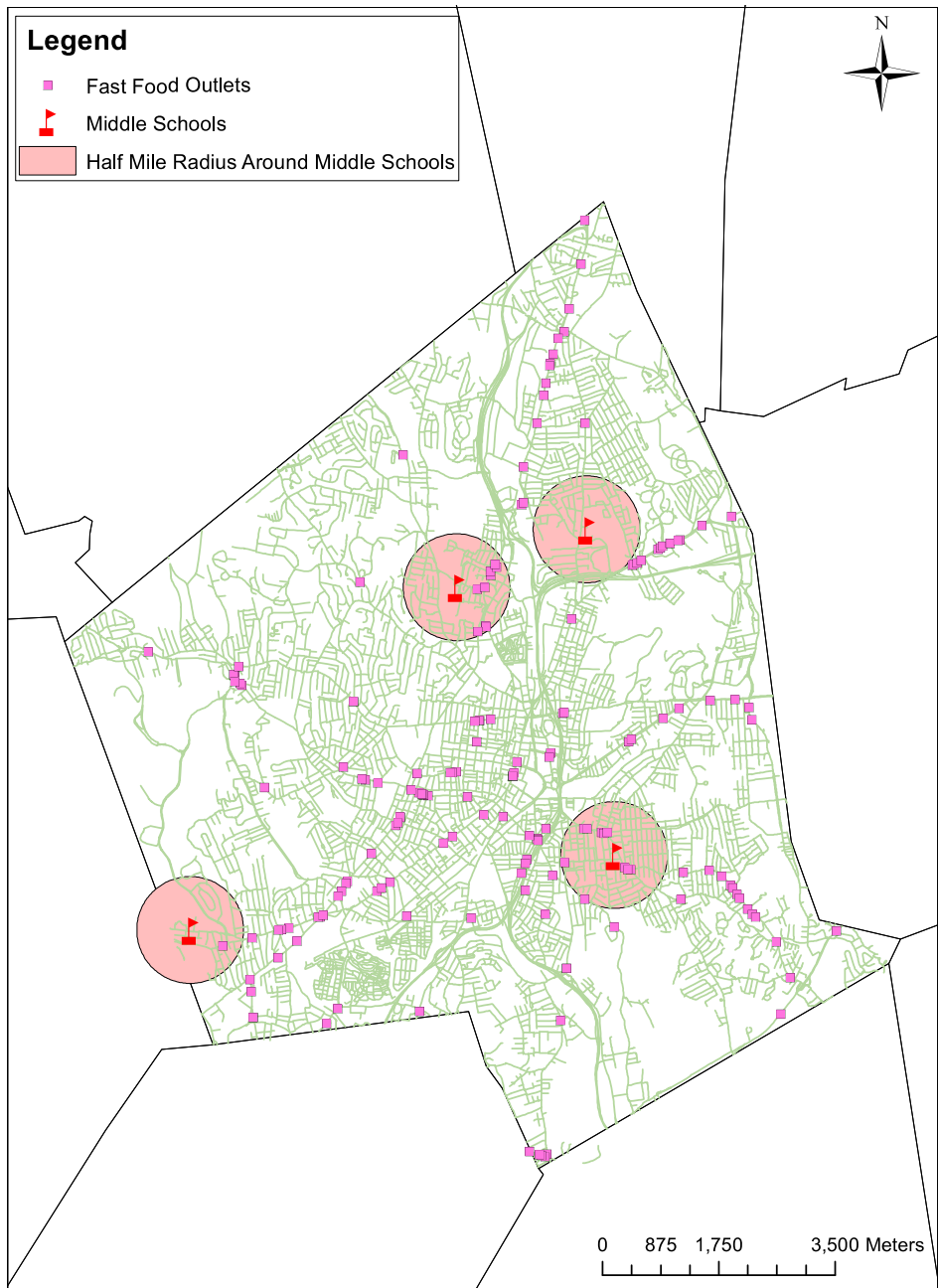
Figure 15: Proximity of fast food outlets to Worcester middle schools

Legend

⬠ Corner Stores

🚩 Middle Schools

▢ Half Mile Radius Around Middle Schools
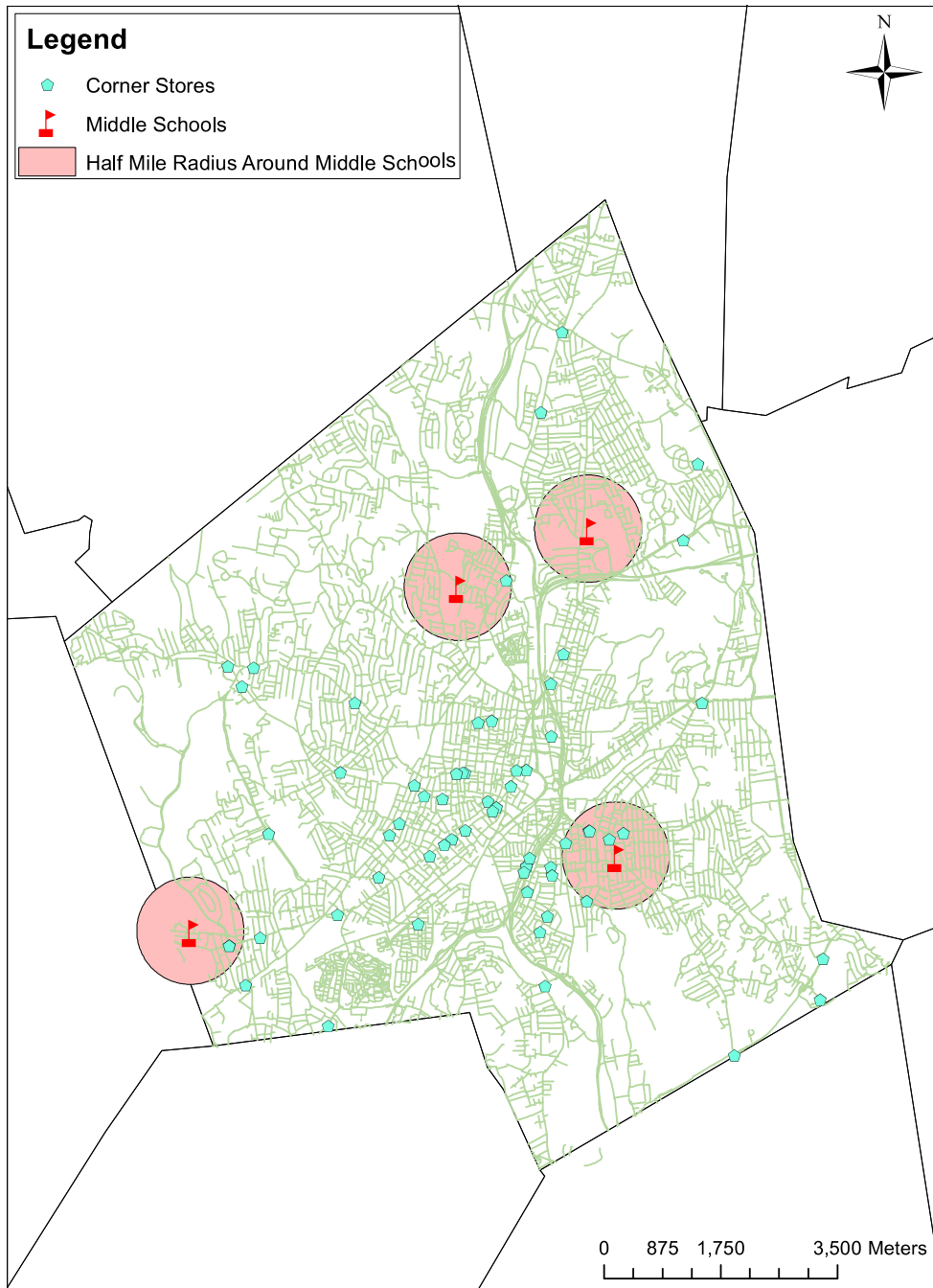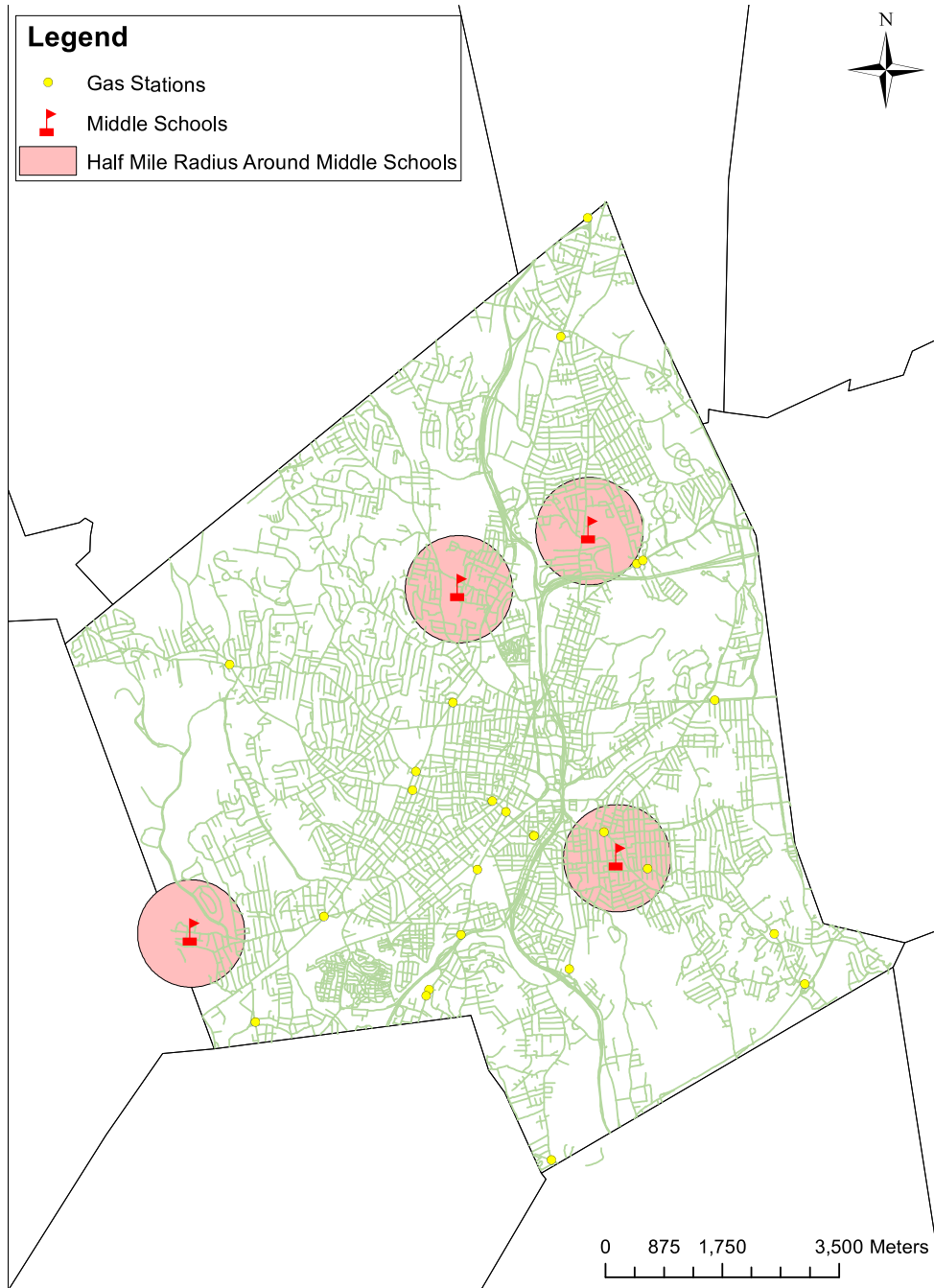
0   875 1,750   3,500 Meters

Figure 16: Proximity of corner stores to Worcester middle schools

Figure 17: Proximity of gas stations to Worcester middle schools

Table 1 expresses the proximity of these fast food outlets with respect to high schools. About 27.8 percent of fast food outlets, 41.3 percent of corner stores and 20 percent of gas stations in Worcester are within a half-mile of a high school.

Table 1: Proximity of food outlets to high schools in

Within Half Mile of Worcester High School			
Food outlet	Within	Total	Percentage
Fast Food	47	169	27.8
Corner Store	26	63	41.3
Gas Station	5	25	20

Furthermore, Table 2 shows a lower percentage of fast foods, corner stores, and gas stations located around middle schools. This may indicate that fast food outlets take advantage of the independence, hence the greater buying power many teenagers get when they are in high school (He, et al., 2012).

Table 2: Proximity of food outlets to middle schools in

Within Half Mile of Worcester Middle School			
Food outlet	Within	Total	Percentage
Fast Food	20	169	11.8
Corner Store	9	63	14.3
Gas Station	2	25	8

Figure 18 shows the corner stores with respects to Worcester bus stops. The bus stops are departure spots for Burncoat High, Claremont, Doherty, North, South, and Worcester Technical. The bus stops tend to be on major roads which would lead to them being close to food outlets.
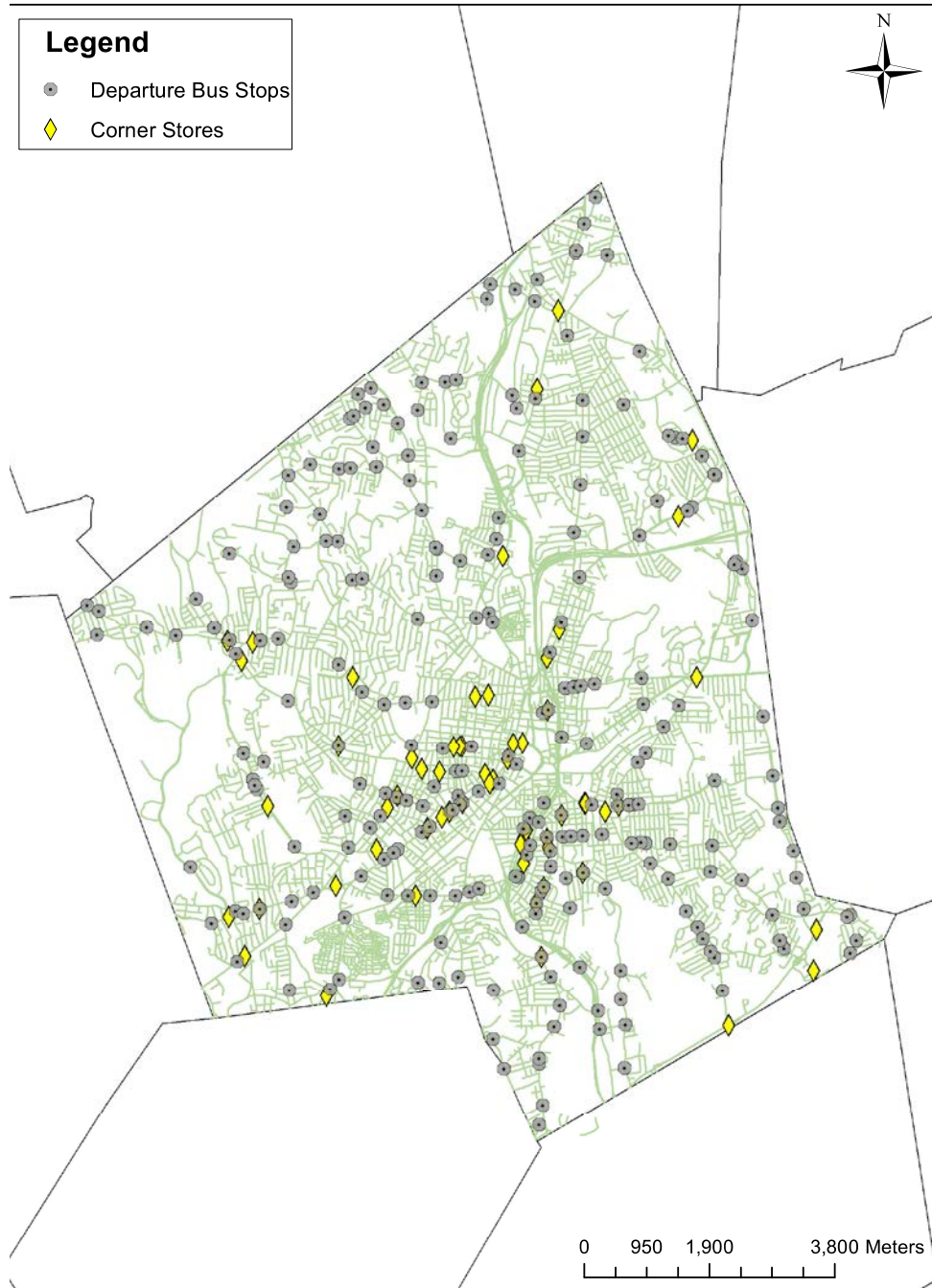
Figure 18: Proximity of corner stores to Worcester high school bus stops

Table 3 shows the results of the bus stops. About 90 percent of both the Worcester corner stores and fast food outlets along with 80 percent of gas stations were within a quarter mile of a school bus stop. These high percentages show that students are being dropped off very close to food outlets that offer unhealthy food which, with bad food choices, can lead to unhealthy lifestyles.

Table 3: Proximity of food outlets to high school bus stops

Within Quarter Mile of Worcester School Bus Stop			
Food outlet	Within	Total	Percentage
Fast Food	149	169	88.2
Corner Store	57	63	90
Gas Station	20	25	80

5.0 CONCLUSIONS

At the beginning of the project, we believed that obesity was the main theme of the project due to a plethora of research-which described obesity as a problem for high school students. Specifically, data about the city of Worcester indicated an obesity issue in children and adolescents. While there is a definite problem with obesity, the focus of the project shifted due to the responses from the students in the Keystone group at the Boys and Girls Club. They understood obesity is an issue but they also brought up other categories like the meaning behind food, advertisements of food and general eating habits. The discussion of these other topics shifted the focus of the project from obesity to the analysis of food choice and the local school foodscape.

Although the much research suggests that the food choices of adolescents are determined by advertisements, by the food retail outlets near schools, and by the efforts of the food industry to create foods that are quasi-addictive, we found that the Keystone group students make food choices that are quite varied. Adolescents can be thoughtful when it comes to food choice and eating can be a very complex decision process. After conducting focus groups and distributing food journals, the most important findings can be categorized as social and environmental.

We found that many of the students skip meals, snack on a regular basis, eat at fast food restaurants, and eat as a social activity. Cultural and familial aspects of food were also noted. For example, some of the participants had a Latino or Caribbean origin; therefore, their meals differed from the rest of the participants that have a solely American background.

Environmentally, it was found that advertisements, corner stores and fast food restaurants played a role in adolescent's food choices. Some research shows that fast food restaurants cluster around schools, but our GIS findings proved otherwise. Instead of directly clustering around schools and bus stops, the fast food outlets are primarily on main roads.

Looking back on our collaboration with the Keystone Group students, we would change a number of our interactions:

1. *More motivational/engaging activities:*
   - During the first focus group with the Keystone group, they seemed really interested, as it was the biggest focus group that was done. However, as time

progressed, the students seemed less interested and fewer of them would show up to the focus groups. Thinking of more motivational and riveting activities to do during the focus groups would have kept the students interested in the project.

2. *Comparing responses from group to 1v1*
   - Focus Groups were always done as a whole group discussion and the Keystone Group seemed very comfortable with that. However, having more 1-on-1 conversations with the group members may have led to different responses to questions since they may not have been influenced by their friends' answers.

3. *Eliminating big tasks (journal writing) and make more small, manageable tasks (take 1 picture of …)*
   - The Keystone Group was mainly given two journal-writing assignments to do. The students probably felt that the journal writing was more of a chore and added another thing to do on top of other school assignments. Smaller, easier, more manageable tasks could have replaced the journal writing so that information could still be obtained for the projects but the Keystone students could easily have gotten the assignments done. Having them do small little tasks every week might have been a better way to divide some of the more daunting tasks. For example, assigning them to bring in a picture of one advertisement one week and then discussing the advertisements they brought in. Doing this keeps the students engaged in the project without overwhelming them and having it become a chore.

Along with changes to our methods, we recommend, future areas for research and community action.

Our research could form the basis for a peer to peer learning program. The Keystone group is composed of leaders at the Boys and Girls club, and they have expressed interest in organizing discussions of these topics in their respective high schools. A further implication could be in policy work or educational campaigns regarding healthy food choice initiative. The Keystone group with the help of the Boys and Girls club could possibly start up a campaign to concentrate on healthier eating habits. In addition the GIS data can be used by the Worcester Food and Active Living Policy for initiatives such as healthier corner stores or advertisement regulation.

6.0 REFERENCES

Alviola, P., Nayga, R., & Thomsen, M. (2013). Food deserts and childhood obesity. *Applied Economic Perspectives and Policy, 35*(1), 106-124. doi: 10.1093/aepp/pps035

Benson, L., & Mokhtari, M. (2011). Parental Employment, Shared Parent–Child Activities and Childhood Obesity. Journal of Family and Economic Issues, 32(2), 233-244.

Berg's Qualitative Method

Campbell, Marcia Caton, 2004. "Building a Common Table: The Role For Planning in Community Food Systems", Journal of Planning Education and Research 23:341-355.

Cavadini C, Siega-Riz AM, Popkin BM. US adolescent food intake trends from 1965 to 1996. West J Med. 2000 December; 173(6): 378–383

Centers for Disease Control and Prevention (CDC). National Center for Health Statistics.Data on obesity described by researchers at centers for disease control and prevention (2011). Available at http://www.cdc.gov/nchs/data/databriefs/db50.pdf Accessed April 10, 2013.

Committee on Communications, & Committee Communications. (2006). Children, adolescents, and advertising. *Pediatrics, 118*(6), 2563-2569. doi: 10.1542/peds.2006-2698

Davis, B., & Carpenter, C. (2009). Proximity of Fast-Food Restaurants to Schools and Adolescent Obesity. *American Journal of Public Health, 99*(3), 505-510.
Davison, T. E., & McCabe, M. P. (2006). Adolescent body image and psychosocial functioning. *The Journal of Social Psychology, 146*(1), 15-30. doi: 10.3200/SOCP.146.1.15-30

Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: public-health crisis, common sense cure. *Lancet*. 2002;360:473-82.

Finkelstein, E. A., Trogdon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual medical spending attributable to obesity: Payer-and service-specific estimates. Health Affairs (Project Hope), 28(5), w822-W831. doi:10.1377/hlthaff.28.5.w822

Gable, S., & Lutz, S. (2000). Household, Parent, and Child Contributions to Childhood Obesity. Family Relations, 49(3), 293-300.

Gordon, Cynthia; Purciel-Hill, Marnie; Ghai, Nirupa; Kaufman, Leslie; Graham, Regina; Van Wye, Grethch (2011) Measuring food deserts in New York City's low-income neighborhoods

He, M. Z., Tucker, P., Gilliland, J., Irwin, J. D., Larsen, K., & Hess, P. (2012). The Influence of Local Food Environments on Adolescents' Food Purchasing Behaviors. International Journal of Environmental Research and Public Health, 9(4), 1458-1471.

Jeffery, Robert; Baxter, Judy; McGuire, Maureen; Linde, Jennifer (2006) Are fast food restaurants an environmental risk factor for obesity? DOI: 10.1186/1479-5868-3-2

Key, T. J., Greenwood, D. C., Stephen, A. M., Mishra, G., Kuh, D., Keogh, R. H., ... (2011). Dietary fat and breast cancer: Comparison of results from food diaries and food-frequency questionnaires in the UK dietary cohort consortium. The American Journal of Clinical Nutrition, 94(4), 1043-1052. doi: 10.3945/ajcn.111.015735

Lee, H. (2012). The role of local food availability in explaining obesity risk among young school-aged children.

"MassGIS Datalayers." MassGIS Datalayers. N.p., n.d. <http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/layerlist.html>.

McNeil, Lorna; Emmons, Karen (2011) GIS Walking Maps to Promote Physical Activity in Low-Income Public Housing Communities: a Qualitative Examination. DOI: dx.doi.org/10.5888/pcd9.110086

Mikkelsen, Bent Egberg, 2011. "Images of foodscapes: Introduction to foodscape studies and their application in the study of healthy eating out-of home environments." *Perspectives in Public Health*, 131:209

Moss, M. (2013). The Extraordinary Science of addictive Junk Food. *The New York Times*, 1-14.

Neumark-Sztainer, D., Story, M., Perry, C., & Casey, M. A. (1999). Factors influencing food choices of adolescents: Findings from focus-group discussions with adolescents. *Journal of the American Dietetic Association, 99*(8), 929-929. doi: 10.1016/S0002-8223(99)00222-9

NIH (2013). [ONLINE] Available at: www.nih.gov. [Last Accessed April 29, 2013].

Nixon, Hilary; Doud, Lauren (2011) Do Fast Food Restaurants Cluster Around High Schools? A Geospatial Analysis of Proximity of Fast Food Restaurants to High Schools and the Connection to Childhood Obesity Rate. DOI: dx.doi.org/10.5304/jafscd.2011.021.007, pp. 181–194

Ogden CL, Carroll MD, Kit BK, Flegal KM.Prevalence of obesity in the United States, 2009–2010. NCHS data brief, no 82 Hyattsville, MD: *National Center for Health Statistics.* 2012.

Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. JAMA. 2012;307:483-90

Parham, Marti. (2008). Study shows food diaries beneficial to weight loss. Jet, 114(6), 13

Pears, S. L., Jackson, M. C., Bertenshaw, E. J., Horne, P. J., Lowe, C. F., & Erjavec, M. (2012). Validation of food diaries as measures of dietary behaviour change. Appetite, 58(3), 1164-1168. doi: 10.1016/j.appet.2012.02.017

Pi-Sunyer, F., Hansen, B., Higgins, M., Hill, J., Howard, B., Kuczmarski, R., . . . Expert Panel Identification, Evaluation, T. (1998). Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: Executive summary. American Journal of Clinical Nutrition, 68(4), 899-917

Purnell, B. (2006). Photographic food diaries for nutritional analysis: A multi-dimensional picture: R gregory, L walwyn, S bloor, S amin. A feasibility study of the use of photographic food diaries in the management of obesity. pages 66–68. Practical Diabetes International, 23(2), 51-51. doi: 10.1002/pdi.892

Sandoval (2013). www.healthycornerstores.org. Health on a Shelf.

Scully, M., Wakefield, M., Niven, P., Chapman, K., Crawford, D., Pratt, I. S., . . . NaSSDA Study Team. (2012). Association between food marketing exposure and adolescents' food choices and eating behaviors. *Appetite, 58*(1), 1-5. doi: 10.1016/j.appet.2011.09.020

Singh AS, Mulder C, Twisk JW, van Mechelen W, Chinapaw MJ. Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obes Rev*. 2008;9:474-88.

Sokol, R. J. (2000). The chronic disease of childhood obesity: the sleeping giant has awakened. The Journal of pediatrics, 136(6), 711-713.

Story M, Resnick M. Adolescents' views on food and nutrition. J Nutr Educ. 1986;18:188-192.

Vendrell, J., Broch, M., Vilarrasa, N., Molina, A., Gómez, J. M., Gutiérrez, C., . . . Richart, C. (2004). Resistin, adiponectin, ghrelin, leptin, and proinflammatory cytokines: Relationships in obesity. Obesity, 12(6), 962-971. doi: 10.1038/oby.2004.118

Warner, Brandy A. Student author -- AE, Patel, Neel Yogesh Student author -- ME, Filice, James Nicholas Student author -- ECE, Allen, David Albert Student author -- CM, & Hersh, Robert, Faculty advisor -- ID. (2012). *Analyzing food security in worcester*. Worcester, MA: Worcester Polytechnic Institute.

World Health Organization Consultation. (2000). Obesity: Preventing and managing the global epidemic - introduction. (pp. 1-253). GENEVA: WORLD HEALTH ORGANIZATION.