

ASSESSING THE AVAILABILITY AND ACCESS TO
HEALTHY FOODS IN TULSA, OKLAHOMA

By

EMILY MICHELLE WINDEN

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Thesis Approved:

Dr. Nancy Betts, Thesis Adviser

Dr. Deana Hildebrand

Dr. Kevin Fink

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Name: EMILY MICHELLE WINDEN

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Abstract: A study of healthy food availability was conducted in the Kendall-Whittier and Eugene Field neighborhoods in Tulsa, Oklahoma. The Nutrition Environment Measures Survey in Stores (NEMS-S) was used to compare the healthy food availability within these neighborhoods with immediately surrounding areas. The Kendall-Whittier and Eugene Field neighborhoods were selected due to their low socioeconomic status as evidenced by high number of students on free and reduced lunch; in addition, these neighborhoods have high minority populations. A total of 107 stores were surveyed consisting of grocery stores, convenience stores and a group called "other" that was made up of dollar-type stores and pharmacies. For each store, a Healthy Food Availability Index (HFAI) score was calculated to represent the overall availability of healthy food options. The survey consists of 13 food categories and compares a healthy and a regular option for each category. The results showed that the mean HFAI for grocery stores was significantly higher than convenience or other stores and the mean HFAI score for other stores was significantly higher than the mean score for convenience stores. There was not a significant difference between the types of stores that were available inside Kendall-Whittier and Eugene Field neighborhoods versus the surrounding area surveyed. There was however a significant difference between the mean HFAI score for grocery stores versus convenience stores and other stores. This indicates that there is limited access to healthy food. The healthy options that were missing most often were fresh vegetables, fresh fruits, low fat milk and lean meats. Recommendations for further studies in Tulsa and the use of NEMS in the future were made.

Keywords: Nutrition Environment Measures Survey in Stores, NEMS-S, Food Desert, Tulsa, Healthy Food Availability Index, HFAI

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION.....	1
II. REVIEW OF LITERATURE.....	6
III. METHODOLOGY	22
Statistical Analysis.....	30
IV. FINDINGS.....	32
Store Characteristics	32
Milk.....	33
Fruits	34
Frozen and Canned Fruit.....	35
Vegetables.....	35
Frozen and Canned Vegetables.....	36
Ground Beef.....	36
Hot Dogs	37
Frozen Dinners.....	38
Baked Goods.....	38
Bread.....	38
Cereal	39
HFAI	40
V. DISCUSSION	41
VI. CONCLUSION.....	45
Limitations	46
Future Recommendations	47
Implications of Field of Nutrition.....	48
VII. REFERENCES.....	50

VIII. APPENDICES	54
A. IRB Approval.....	55
B. Nutrition Environment Measures Survey (NEMS).....	56
C. Oklahoma State University NEMS-S Scoring Sheet	89

LIST OF TABLES

Table	Page
Table 1: Frequencies of Stores.....	32
Table 2: Frequencies of Stores Reduced.....	32
Table 3: Frequencies of Stores between Neighborhoods.....	33
Table 4: Chi Square of Store Type Within Neighborhoods.....	33
Table 5: Overall Availability	33
Table 6: Chi Square of Milk Availability by Store Type.....	34
Table 7: Number of Stores by Lowest-Fat Milk Content	34
Table 8: Chi Square of Fresh Fruit Availability	34
Table 9: Chi Square of Healthy Frozen Fruit Availability	35
Table 10: Chi Square of Healthy Canned Fruit Availability	35
Table 11: Chi Square of Fresh Vegetables Availability	35
Table 12: Chi Square of Healthy Frozen Vegetables Availability	36
Table 13: Chi Square of Healthy Canned Vegetables Availability	36
Table 14: Chi Square of Ground Beef General Availability.....	37
Table 15: Chi Square Availability of lean Ground Beef (< 10% fat, 90% lean).....	37
Table 16: Chi Square of Hot Dogs General Availability	37
Table 17: Chi Square Availability of Hot Dogs Healthier Option.....	37
Table 18: Chi Square of Healthy Frozen Dinner Availability	38
Table 19: Chi Square Availability of Healthy Baked Goods.....	38
Table 20: Chi Square of Bread General Availability.....	39
Table 21: Chi Square of 100% Whole Wheat.....	39
Table 22: Chi Square of General Cereal Availability.....	39
Table 23: Chi Square of Healthy Cereal Availability.....	39
Table 24: Comparison of Mean Scores on the Healthy Food Availability Index.....	40
Table 25: Linear Regression on HFAI Score.....	40

CHAPTER I

INTRODUCTION

Obesity is increasing rapidly in our country and it has its greatest effects on low income populations.¹ Overall, according to Mantel, “One-third of children and two-thirds of adults are overweight or obese, posing a daunting public-health challenge.” Obesity increases an individual’s risk of developing additional health conditions including cancer, type two diabetes, and cardiovascular disease.² In the United States, obesity is associated with 1 in 10 deaths making it the second leading cause of preventable deaths. In 2001, the Surgeon General labeled obesity an epidemic and since then, obesity has shown no signs of abating.³ As of 2013, obesity has cost Americans over \$190 billion every year. Researchers believe that if the current trend in America continues, obesity could easily cost \$861 to \$957 billion by 2030.⁴

Based on information that was self-reported to the Behavioral Risk Factor Surveillance System (BRFSS) in 2012, 32.2% of Oklahoma’s adult population is obese.⁵ In 2013, the United Health Foundation ranked all of the states in the United States based on how healthy they were.⁶ Oklahoma ranked 44th overall for health, 45th for obesity and 43rd for diabetes. This indicates that there are only five states with a higher percentage of individuals that are heavier than Oklahomans and six states that are less healthy than Oklahoma. In Tulsa County, 29% of the adults are obese, slightly lower than the state average.⁷

Chetrick thinks lack of access to healthy foods could be contributing to the obesity epidemic because people are purchasing food that is easily accessible, cheap and unhealthy.⁸ Researchers have begun using the term “food desert” to describe areas with limited access to food. While the term “food desert” has become popular in the media and in the field of health care there is no definition in the Merriam-Webster dictionary. The United States Department of Agriculture (USDA) defines a food desert as an area outside one mile of a grocery store in urban areas and outside ten miles in a rural area.⁹ Walker et al. defines a food desert as a “geographic area that did not have a large chain supermarket within 0.5 miles from the zip code centroid, the center of the defined area identified by latitude and longitude coordinates.”¹⁰

Some argue that it does not make sense for people in food deserts, with limited access to food, to be overweight. However, Schafft et al. suggest that the problem is the type of foods available within the food desert- most often products high in calories, sugar and sodium.¹¹ Schafft et al. studied students from 160 school districts when they were in fifth grade and again in seventh grade. There was a statistical difference in the likelihood of students who lived in food deserts being at risk for obesity compared to the non-food desert students. Researchers concluded that schools located in food deserts need to acknowledge that their students have a greater potential for health risks, and would possibly benefit from nutrition education, increased physical activity opportunities, and healthy school lunch meals.

Low income families are more likely to live in areas with limited access to healthy food.¹¹ One study stated that lower income communities had 25% fewer grocery stores and convenience stores were 1.3 times as prevalent.¹² Food deserts can be seen all around the country, but the reason for studying this issue in Tulsa County is the demographics of the community. The numbers are shocking: “More than 87,000 people in Tulsa County live in poverty.”¹³ In the City of Tulsa one in three children under the age of five live in poverty and in North Tulsa it is even worse with one in two children living in poverty. Over 80% of students

enrolled in Tulsa Public Schools qualify for free or reduced-price meals. Receipt of free or reduced price meals in the National School Lunch Program is based on the family's size and income.¹⁴ If the family's income is at or below 130% of the poverty line then the child is eligible for free meals and if it is between 130 and 185% then they are eligible for reduced-price meals.

Not only was lower income indicative of having fewer supermarkets available in an individual's neighborhood, but research showed that ethnicity also contributed to fewer supermarkets in a neighborhood.¹² Even after researchers adjusted for income there were 41% fewer supermarkets available in African American neighborhoods compared to White neighborhoods in urban areas. Predominately Asian and Hispanic neighborhoods had more supermarkets than African American neighborhoods, but they still had significantly fewer than White neighborhoods.

Many studies of food environments focus on supermarket presence but often exclude other food venues such as restaurants. All available food venues create an individual's food environment and paint a picture for researchers of what is available to consumers. Fast food is high in fat and calories and studies show that intake of fast food is associated with increased weight and body mass index (BMI).¹⁵ An increase in fast food consumption may be the most important change in American diets that has led to an obesogenic society. A study was conducted in New Orleans where researchers mapped all fast-food restaurants in the area and calculated restaurant density for each census tract. The results showed that for every 10% increase in the fast-food restaurant density there was a 4.8% decrease in the median income and a 3.7% increase of Black residents. Areas with 80% Black residents had 2.4 fast food restaurants per square mile versus 1.5 in areas with 20% Black residents. These results indicate that fast-food restaurants are associated with predominately Black and low-income areas. Researchers believe that this may help explain the increased rate of obesity in Black and low-income individuals.

For the current study, the two neighborhoods that were examined were in the low income neighborhoods of Eugene Field and Kendall-Whittier in Tulsa, OK. The student population of Eugene Field is comprised of 35.5% African American, 20.89% Hispanic, and 20.89% Caucasian students.¹⁶ As of October 1, 2013, 96.44% of the school children were eligible to receive free or reduced price meals. The demographics differ slightly at Kendall-Whittier but the level of poverty is similar. The school children are 7.31% African American, 64.72% Hispanic, and 18.74% Caucasian. Free and reduced-price meals eligibility consisted of 91.31% of the students at Kendall-Whittier. These neighborhoods have a disproportionately high number of minority residents when compared to the rest of the county. As a whole, Tulsa County is 64.6% White Non-Hispanic, 11.4% Hispanic, and 10.9% African American.¹⁷

The purpose of this study is to describe healthy food availability within the Eugene Field and Kendall-Whittier neighborhoods and compare availability in the lower income neighborhoods of Eugene Field and Kendall-Whittier to the surrounding areas. The Nutrition Environment Measures Survey in Stores (NEMS-S) was used to collect the data. The NEMS-S is a survey that looks at the quality, availability and price of ten food categories in grocery stores, convenience, pharmacy-type, and dollar-type stores.¹⁸

The Healthy Food Availability Index (HFAI) is the scoring system that was used to assess the stores that were surveyed. The HFAI was modeled after the original NEMS-S availability score which provides a score between 0 and 27 for each store.¹⁹ For this study the HFAI ranges from 0 to 33 for availability for each store that was surveyed.

Terms and Definitions:

Obese- having body fat above 32% for women, 25% for men, 30% for girls and 25% for boys.²

USDA Thrifty Food Plan- a meal plan that demonstrates how a family of four would meet the minimum recommendations for the 1995 Dietary Guidelines on a modest budget or by using food stamps.²⁰

Walkable neighborhood- where most residents do most errand by walking there and the neighborhoods has streets that connect and have sidewalks.¹⁸

Free and Reduced price meals- Receipt of free or reduced price meals in the National School Lunch Program is based on the family's size and income.¹⁴ If the family's income is at or below 130% of the poverty line then the child is eligible for free meals and if it is between 130 and 185% then they are eligible for reduced-price meals.

CHAPTER II

REVIEW OF LITERATURE

The term “food desert” was first used in 1996 by the United Kingdom Nutrition Task Force’s Low Income Project Team and was defined as “areas of relative exclusion where people experience physical and economic barriers to accessing healthy food.”²¹ The main theories about the development of food deserts in the United States (U.S.) include first, that large, chain supermarkets began to increase in abundance on the outer edge of urban areas.²² These large chains provided more variety at lower prices which eventually caused smaller markets to close because of decreased business. A second theory is that between 1970 and 1988 there was an increase in wealthier families moving to the suburbs. This movement meant that the average income decreased in the urban areas resulting in almost one-half of supermarkets in the three largest U.S. cities closing. The chief disadvantage of larger chain stores displacing smaller markets is that they are located in areas where individuals need to have access to transportation.

When the smaller, more easily accessible markets closed, foods available to individuals became more processed and energy dense because convenience stores and fast-food restaurants have lower inventories. Research shows that a diet consisting of mainly processed foods is usually high in fat, sugar, and sodium which can lead to poor health compared to a diet high in complex carbohydrates and fiber.¹¹

Congress passed The Food, Conservation, and Energy Act of 2008 to address food deserts as a priority.²² This bill called for research on food and nutrition. Section 7527 of the

bill required that the Secretary of Agriculture to address food deserts in the U.S. by researching the prevalence and cause, the effects food deserts have on populations, recommendations for reducing and eliminating food deserts, community development initiatives, incentives for stores to open in food deserts, and partnerships to address food deserts. Before this bill was passed, food deserts were not a popular topic in the U.S.; instead food security, a household measure of hunger, was the basis for most research.

Several studies have demonstrated that increased access to a supermarket is related to decreased risk of the individual being obese. A multi-state study was conducted in Mississippi, North Carolina, Maryland, and Minnesota with over 10,000 adults participating.²³ The results showed that individuals who had access to supermarkets or supermarkets and grocery stores had the lowest prevalence of obese individuals. The greatest prevalence of obesity was seen in census tracts with no supermarkets and only grocery stores and convenience stores. The results showed that access to supermarkets decreases the risk of obesity and increases healthy eating patterns which is why researchers are interested in examining neighborhood food access in greater detail.

The majority of research has focused on race and income differences within food deserts. Researchers believe that this can be related to the increased awareness of health disparities as well as income disparities.²³ Neighborhoods with lower income and higher minority populations are linked to poor eating habits and obesity. A survey conducted with Black and White adults who were at risk for atherosclerosis examined how supermarket presence in their neighborhood contributed to fruit and vegetable consumption. The results showed a relationship between the number of supermarkets located in the individual's census tract and if they met the dietary guidelines for fruit and vegetable consumption. For each additional supermarket there was a 32% increase in meeting these requirements among Blacks but only an 11% increase for Whites.

Along with availability, price also affects purchase of healthier food. USDA started keeping records of the food environment in 1895 beginning with records of milk production.²⁴ In

1968 the American Chamber of Commerce Research Association (ACCRA) began tracking quarterly pre-tax price data on 27 grocery/food categories in certain rural and urban areas of the U.S. In 1984, the USDA created the Consumer Price Index (CPI) which tracks retail food prices. It does have limitations such as lack of sensitivity to market fluctuations, new foods being introduced, spending patterns of consumers and incomplete geographic coverage. Therefore, initially, the majority of price data was obtained by the government and commercial agencies. However, it was not until the 1990's that researchers began to integrate this information with research on food environments.

In 1992, data collected by the Bureau of Labor Statistics was analyzed and showed that while diets consumed by lower income individuals cost less because they consisted of lower quality meat, fish, fruit, and vegetables, they were taking up a larger percent of their expendable income.¹² Similarly, a study conducted in several cities in California showed that, on average, selecting healthier food could increase a family's grocery bill by \$850 to \$960/year.²⁰ In the study, the researchers used market baskets to examine differences in price between normal diets and healthier options that met more dietary requirements. The original market basket was based on the U.S. Department of Agriculture's Thrifty Food Plan. The healthier market basket made alterations for dairy, meat, canned fruit, fats, bread and grains. On average, the healthier basket cost \$36 more and the categories that contributed most to this cost were whole grains, lean ground beef, and skinless poultry. These studies indicate that healthier food options are more expensive and this may be a factor that discourages families from making healthier purchases at the grocery store.

In 2003, researchers used energy density data from nutrition labels and compared them to prices that were obtained from grocery stores in Seattle.²⁵ These two values were used to determine how much each food item cost for how much energy it provided. The cost for energy provided from cookies and potato chips was about 20 cents/megajoule (MJ) whereas fresh carrots

cost about 95 cents/MJ. Another example is soda which cost 30 cents/MJ and orange juice which cost 143 cents/MJ. Similar comparisons showed that healthier options were much more expensive for the amount of energy they provided. The results showed that fats, sugar, refined grains, potatoes and beans were the cheapest options that provided the most energy.

With the proliferation of chain groceries and supermarkets located in the suburbs, it was thought that access to healthy food was more difficult in urban and lower income neighborhoods.²² Price was also thought to be substantially higher in urban areas and in convenience type stores compared to grocery stores. However, until recently, it has been difficult to determine the effect of access and price due to the lack of standardized instruments for measuring the food environment.

Initial tools to measure the food environment included checklists, shelf space analysis, market basket inventories, and interviews/questionnaires.^{24,26,27} Glanz and colleagues examined the food inventory of 77 stores in San Diego by completing an availability checklist with 71 heart-healthy foods.²⁴ This tool had high inter-observer agreement. Results showed that the highest availability of heart-healthy foods were available in supermarkets, followed by neighborhood grocery stores and the fewest healthy options were available in convenience stores.

Another study conducted by Cheadle and colleagues examined low-fat, high-fiber items.²⁶ While in the grocery stores surveyors looked at four main categories: fresh produce, meat, milk and bread. First, they determined if the healthy options were available and if so they were to record how much physical space the product occupied in the store. Trained surveyors measured the actual dimensions of what was available in these four areas in 37 stores in the Seattle area initially and then in another 61 stores in five different counties. The goal of this study was to determine how much space was devoted to the healthier options in these four categories. Fish and chicken were considered healthy meat options, and reduced-fat milk and

100% whole wheat bread were the other healthy options that were studied. Results from this study showed that there was not a significant difference in how much space was allotted for healthy items between independent and chain stores. While the food item availability had high reliability, sales data would represent consumer consumption more accurately; however this is an appropriate tool for researchers to quickly judge which products are being consumed in certain areas.

Market basket is another tool used by researchers to measure what is available in a store and price variance between healthier and less healthy options. A study conducted in two Chicago suburbs used market basket analysis to examine how prices and availability differed between a low income, predominately Black neighborhood and a neighborhood of mixed race and financially better off residents.²⁷ The grocery list was compiled from the USDA's Thrifty Food Plan. Dollar type stores, gas stations, and specialty stores were eliminated from the study because they carried a low number of items on the list which skewed the price of the basket because they were not able to evaluate each item on the list. The stores that were surveyed could only be compared with other stores that had similar items in order to compare the basket price. After their analysis, researchers determined that the market basket was not an effective tool to compare across stores. The variability of products among stores resulted in baskets with widely variable composition.

Two tools were used in the 1990's to examine availability and accessibility by measuring home food environments.²⁴ The first tool, created by Hearn and colleagues, was a survey to measure fruit and vegetable availability. This survey, using Cronbach's alpha, had an internal consistency of 0.69. The second tool, utilized by Patterson and colleagues, was a quick food inventory of a house gathered over a telephone interview. The focus of the study was to evaluate the availability of high-fat and reduced-fat foods in the home; based on chi-square tests this significantly correlated with the individuals' energy intake from fat. While each of these tools

provides information about food availability to consumers they have limitations which led researchers to develop Nutrition Environment Measures Survey in Stores (NEMS-S), a uniformed tool to assess availability of healthy food.

Glanz et al. reviewed tools being used to analyze food environments.²⁴ The authors believed individual-level interventions to change the diet are challenging due to outside or environmental factors that affect diet quality, energy intake, and weight. They also believed that increased efforts to educate policymakers on how food availability policies can improve healthy food options and decrease obesity were important. To educate policy makers requires clear data outlining the problem. The Nutrition Environment Measures Survey (NEMS) was created to give researchers an objective way to assess the availability, price, shelf space and quality of food in communities.¹⁸ A standardized method for clearly describing all aspects of the food environment served to advance research and influence change in public policy.

Nutrition Environment Measures Survey (NEMS) is a survey that has ten categories where the surveyor compares a healthy option to a less desirable option for each category.¹⁸ Stores are scored based on whether healthy options are available, how much each item costs and the quality of fresh produce. Points are assigned for healthier options if they are available, less expensive and of good quality. Additionally, shelf space is measured for each fat value of milk and an extra point is awarded if the shelf space for the lowest fat milk is greater than for whole milk. Therefore a higher score indicates more access to healthy options.

NEMS was developed by Glanz and her research team after a review of previous literature, collaboration with other researchers and a field test of the tool in two neighborhoods.¹⁸ For the list of items to survey, researchers identified foods that contribute most to fat and calories in the American diet and items that are suggested for healthy living. Ten categories were developed to survey: fruits, vegetables, ground beef, milk, hot dogs, frozen dinners, baked goods,

beverages, whole grain bread, and baked chips. Specific fruits and vegetables in the survey were selected based on national produce consumption and sales, (researchers excluded potatoes). Each type of produce was also scored as acceptable or unacceptable, based on the quality for the item.

An overall score was determined for each store based on availability, quality and price.¹⁸ Each food category was given two points if the healthy option for a category was available and an extra point if several varieties were available. If the healthier option was cheapest then the category was given two points for price and if it was more expensive then it got a score of -1. A category could receive up to three points for quality if there was a large selection of acceptable quality items in that category. When totaling the scores for availability, price and quality a store could receive a total score between -8 and 50. The Healthy Food Availability Index (HFAI) describes specifically the subcategory of availability and assigns each store a score between 0 and 30.¹⁹ This allows researchers to quickly compare stores strictly based on what is available.

After the pretests, a study was conducted in four neighborhoods in Atlanta to measure nutrition environments, assess the tool's reliability, and observe differences in environments in lower and higher income areas.¹⁸ Each neighborhood had at least fifteen food outlets and the specific neighborhoods were selected to give researchers a look at diverse incomes and walkability. This data was obtained from the 2000 U.S. Census, SMARTRAQ study and the Georgia Regional Transportation Authority. Researchers used data from county retail food license lists, Georgia Regional Transportation Authority and the Yellow Pages to compile a list of stores and then categorize them into either grocery stores or convenience stores.

All of the grocery stores in the neighborhoods agreed to participate in the study for a total of 24 stores surveyed, but several convenience stores declined resulting in 58 out of 64 being surveyed.¹⁸ Chi square and t-test were used to compare descriptive statistics and neighborhoods. Grocery stores had significantly more items available except for 100% fruit juice, diet soda, and

baked chips. Convenience stores had fruit juice and diet soda available more often but had fewer varieties of baked chips than grocery stores. Stores in higher income neighborhoods had significantly more healthy options except for diet soda, 100% fruit juice, and low-fat hot dogs. The only difference between neighborhoods that were more walkable was that they had whole grain bread available more often. The overall scores were as predicted with availability, quality, and total scores higher in grocery stores and higher income neighborhoods than convenience stores and lower income neighborhoods. The scores for price were different than expected in the convenience stores and lower income neighborhoods had higher scores indicating lower prices.

To test the inter-rater reliability two raters were sent to the same store on the same day at different times to see how the scores differed.¹⁸ In order to conduct test-retest reliability, stores were resurveyed seven to twenty-eight days after the first survey was completed. The statistics showed that inter-rater reliability was consistently high indicating that the training protocol developed by researchers prepared surveyors to collect quality data. Test-retest reliability showed similar results to the inter-rater reliability, suggesting that several surveys are not required to achieve a consistent description of the nutrition environment

This tool only allows researchers to look at the food environment and Glantz et al. suggest that more research needs to be done on how the food environment plays a role in consumers' eating habits.¹⁸ One limitation of the NEMS is the amount of time it requires to complete a survey. Not only does the surveyor have to complete the survey in the store they have to travel to the site and researchers also have to spend a significant amount of time training surveyors and compiling the list of stores to be surveyed. The results from this study indicate that NEMS-S is a tool that is reliable, valid, and can be used in different geographic locations.

NEMS-S and HFAI are useful tools to compare the availability, quality, and price of food among differing communities. Many researchers have coupled these scores with racial, income,

or socioeconomic data to compare healthy food availability among communities. For example, Krukowski used census data to compare availability of food in areas with higher median incomes to those with lower incomes and higher percentages of African Americans.²⁸ Similarly, Franco et al. compared food availability in three areas: predominately White, predominately Black, and racially mixed.¹⁹ While Kurkowski and Franco split communities based on race, Chetrick and Anderyeva compared communities based on income levels.^{8,29} Chetrick took the study one step further and compared healthy food availability with childhood obesity rates within the community.

Kurkowski conducted a study in Little Rock, Arkansas and Burlington, Vermont to determine if neighborhood demographics and the location or size of the store had an impact on what foods were available and their prices.²⁸ Participants were recruited through a weight loss program and were asked where they did their primary grocery shopping. The stores that were reported as being the primary source of groceries were surveyed using NEMS-S. Census tract was used to obtain racial and financial information for each neighborhood and this study specifically looked at median household income and the percentage of African Americans in the neighborhood. Price, availability, and quality scores obtained from the NEMS-S surveys were compared with neighborhood features such as income, race, and size of the store. The results showed that income was significantly related to the availability score and store size was only significantly related to the price score. The findings indicated that there was significantly less low fat milk available in predominantly African American neighborhoods. One main weakness of this study is that the researchers only surveyed the grocery stores that participants said they shopped at and not all of the grocery stores in the area and while one participant reported that their main source of groceries came from a convenience store the researchers did not evaluate this food location because it did not fall within the grocery store category which they were specifically examining.

In a similar manner, Franco et al. surveyed 226 food stores in the Baltimore area using NEMS-S and the HFAI scores to rate each store.¹⁹ The researchers believed that there would be less healthy food available in poorer neighborhoods and neighborhoods that were predominantly Black compared to White neighborhoods and higher income neighborhoods. The researchers also hypothesized that similar stores would not have the same options available in differing neighborhoods.

Data for income and race was obtained from the 2000 U.S. Census.¹⁹ In order for a neighborhood to be considered either predominantly White or Black there had to be more than 60% of that race otherwise it was considered racially mixed. Researchers looked to see what the associations between race and income were with healthy food available. The HFAI and type of store was compared with race and income using chi-square tests. Different types of stores and similar stores in different neighborhoods were compared by looking at the HFAI score and testing with ANOVA or t-tests.

HFAI scores were split into three groups, the lowest scores were present in 43% of Black neighborhoods and only 4% of White neighborhoods while the highest score group was present in 19% of Black neighborhoods and 68% of White neighborhoods.¹⁹ The mean HFAI was calculated for neighborhoods based on race and income. The mean HFAI score for Black neighborhoods was 5.48 and 13.04 for White neighborhoods while the difference between low and high income neighborhoods was 8.1. Regression analysis indicated that the type of store and location were independently associated with availability.

Researchers suggest that a change in the food environment will require help from different government, scholar and community groups.¹⁹ The results of this study showed that minority and low income neighborhoods have sufficient store options but that the options in the

stores were not sufficient. One strategy for improving the nutrition environment would be to increase the healthy options available in the already existing stores.

Like Kurkowski and Franco, Andreyva conducted a study to compare food environments among communities. However, in their study of New Haven, Connecticut communities researchers divided communities by income level rather than race.²⁹ Researchers used NEMS-S to look at the availability, price and quality of food in four different neighborhoods that covered both low income and wealthier neighborhoods. Availability was different in each store according to product but overall there were significantly more options available in grocery stores and the only healthy options that were similar, between grocery and convenience stores, for most all stores were canned vegetables, baked chips, and beverages. Often convenience stores did not have the healthy options available but did have the regular options.

Researchers thought that lower-income neighborhoods would have less healthy food available, but this only seemed to be the case for milk and chips.²⁹ The results showed that there was a higher availability for fruits and vegetables in poorer areas, but researchers think this may be attributed to wealthier areas having more quick-stop type of stores and that consumers in this area may use these stores for quick purchases when they are in a hurry and travel further to do regular grocery shopping.

Unlike comparisons between race based communities, the results showed that there were no significant differences in price between neighborhoods but prices were 51 percent higher in convenience stores versus grocery stores.²⁹ This study showed that healthier options often cost more except for cereal, cheese and milk and the largest differences in prices were for chips, lean meat and whole-grain pasta. The produce in the lower income neighborhoods was of significantly lower quality than wealthier neighborhoods and there were more differences in fruit than vegetables. New Haven appears to have more grocery stores than cities of similar size such

as Detroit which could explain why these results that differ from many other studies. Since this sample of stores was not large enough researchers stated that the results cannot be transferred to other cities.

In a similar way, researchers in West Virginia used NEMS-S to assess whether there were healthier options available at a lower price in higher socioeconomic status areas when compared to more poverty stricken areas.⁸ Researchers also wanted to see if the nutrition environment was correlated with childhood obesity in the area. The study focused on two counties in West Virginia, Marshall and Monongalia, which are extremely impoverished. The stores in the area, 37 grocery, 46 convenience and 14 department stores, were analyzed using NEMS-S. Researchers compared availability and price by looking at the healthier option and the regular option.

The difference in availability of each food item was determined using Pearson's chi-square test and Fisher's exact test was used to determine if the differences were significant for store type and poverty quartiles with a p value less than 0.05.⁸ The differences in prices by store type and poverty quartile were tested by a two-sample t-test with a p value less than 0.05. The mean score was calculated for availability, price and quality and were represented by means plus or minus standard deviation of the mean. These differences for store type and poverty quartile were computed by using a one-way ANOVA and Post-hoc multiple comparison tests using Scheffe's test with a p value less than 0.05. Consistent with the other studies, results showed that there were significant differences between which items were available at grocery stores and all other stores for fruit, vegetables, ground beef, hot-dogs, frozen dinners, baked goods, and whole grains. Price comparison showed that the healthier options for ground beef and bread cost more while reduced calorie frozen dinners cost less than the regular option.

Researchers were interested in assessing the correlation between nutrition environment and childhood obesity.⁸ In this study, the researchers used the percentage of students on free and reduced price lunch to estimate the level of poverty that was present in the elementary school. BMI was determined by data collected from the Coronary Artery Risk Detection in Appalachian Communities (CARDIAC). Data was collected annually for students aged 5-10 years old including their height and weight and researchers used this data to calculate BMI for each child. A parent survey, which asked about eating habits, physical activity of the child, and the parent's height and weight, was sent home with each of the children that were measured. The results of this study suggest that families that make less than \$50,000 a year have children that are more likely to be obese.

While the other researchers compared availability across communities, Hiller conducted a study to compare availability in the same community before and after a policy change. In 2009, WIC changed their reimbursements to include fruits, vegetables, whole grains and switched from whole to 2% milk.³⁰ In Philadelphia, stores are required to provide at least two varieties of each fruit and vegetable to be able to accept Women Infants and Children (WIC) benefits. There are over 500 stores that can redeem WIC vouchers in Philadelphia and about 400 of them are small corner stores that are predominately located in low income neighborhoods. Researchers were hoping that these small corner stores, which were mainly located in low income areas and often had a high percentage of food with little to no nutritional value, would show the biggest change in inventory after the new WIC standards had been implemented.

The study was conducted in two poverty stricken neighborhoods in Philadelphia, one predominantly African American and the other mainly comprised of Hispanics, to measure the effects of new Women Infant and Children (WIC) requirements.³⁰ Each store was surveyed using NEMS-S before and after the new WIC requirements were enacted to determine if the changes in the NEMS-S scores were significantly different. Both times stores were surveyed the

convenience type stores scored lowest for availability, price and quality while the chain supermarkets scored highest. There was a significant increase in the NEMS-S scores from the original survey to the survey conducted after the WIC changes were implemented. Across all stores the most significant improvements in healthy option availability were milk, juice, and whole-grains – the areas targeted by the WIC changes.

Multiple ordinary least squares (OLS) regression model was used to see if the NEMS-S score after the WIC package was implemented could be predicted using characteristics such as base score, income, percent of Hispanics, type of store, and whether the store participated in WIC redemption.³⁰ The OLS regression model showed that the original score, if the store participated in WIC redemption and the type of store significantly predicted the NEMS-S score after the package implementation.

An interesting discovery from this study that was not explained is why there was more access to fruits and vegetables, low fat milk, and whole grains in neighborhoods that were predominately Hispanic versus the neighborhoods that were made up of mostly African Americans.³⁰ One limitation of this study was that each state had its own policy for WIC food packages and which stores can redeem vouchers so it may not be applicable to all areas. The results of this study showed that by providing reimbursement for certain healthy foods and requiring stores to provide sufficient options to customers may have increased access of healthy food to all residents, whether they received WIC benefits or not. These results are consistent with Franco et al.'s conclusion that improving the quality of food in already existing stores would be a viable alternative to increasing the number of stores in an area.¹⁹

Several researchers have adapted the NEMS-S to make the survey a better tool to evaluate the environment they were studying. Developers of the NEMS-S encourage researchers to customize the survey for their population; providing suggestions and a database of previous

adaptations on their website. Researchers in Texas modified the NEMS-S by adding fruit, vegetables, ready-to-eat produce, dairy, canned goods, bread and grain.³¹ For fruit they added grapefruit, mango, papaya, and a count of all available fruits. They added greens, avocado, yellow squash, zucchini and a count of all available vegetables. The ready-to-eat section consisted of cut-up fruit, bagged lettuce or salad, baby carrots, and cut-up vegetables. To the dairy section they added yogurt, cottage cheese, single slices of cheese, mozzarella string cheese, cheddar block and lower-fat Mexican cheese. They added twelve canned good items to the survey, all were different types of beans. For bread and grains they added buns, dinner rolls, pasta, rice, and flour. Researchers from Arizona also made changes - including tortillas.³² Chile also used the NEMS-S and made several changes, removing hot dogs, frozen dinners, baked goods and added bottled water availability and tortillas.³³ A study was conducted in Baltimore where the researchers adapted NEMS-S by adding a chicken measure, adding soy milk to the milk measure, and removed the frozen dinner measure except for Stouffer's lasagna dinners.¹⁹

The researchers in Baltimore used the Healthy Food Availability Index to score the data and the results showed that lower income neighborhoods had less access than neighborhoods of higher income. The studies in Baltimore and Chile show that the results were statistically significant. This indicates that adaptations can be made to NEMS-S and still result in unbiased and useable data.

In summary, the NEMS-S tool is reliable, validated and unique due to its ability to allow researchers to adapt the tool to accommodate regional and cultural differences. This tool is reliable and validated. In addition, it provides researchers with the advantage of being able to compare results from different areas and studies unlike previous methods for surveying food availability. The NEMS-S is used to quantify availability and affordability of healthy food within a community. The results from studies that have utilized NEMS-S concluded that neighborhoods

of higher income had higher scores than lower income neighborhoods and there were more options available at grocery stores versus other stores.

CHAPTER III

METHODOLOGY

This study was approved by Oklahoma State University Institute Review Board for protection of human subjects, Appendix A. A list of food outlets for Tulsa County was obtained from the Tulsa County Health Department in February 2013 through an open records request for food outlets. The data included the store type, store name, owners name, store address, and phone number. The survey area was defined as Kendall-Whittier and Eugene Field neighborhoods and the surrounding area within Tulsa County, Oklahoma. The Kendall-Whittier and Eugene Field neighborhoods were selected because both areas are predominately composed of ethnic minorities and over 90% of the students at the elementary schools qualify for free and reduced price lunches. Kendall-Whittier and Eugene Field neighborhoods were characterized as zip codes 74104, 74110, and 74107 while the surrounding area consisted of zip codes 74106, 74115, 74120, 74103, 74112, 74127, 74105, 74114, and 74119. The list obtained from the Tulsa County Health Department included 168 stores, grocery stores, convenience stores, dollar type stores and pharmacy stores, to be surveyed in the specified zip codes.

Eighteen volunteers from OSU Cooperative Extension, Tulsa Health Department, Tulsa Food Security Council, Tulsa Food Bank, and OSU Tulsa were recruited to assist in collecting food store data. The volunteers were trained using standard protocol developed for this study. Training sessions were held on five different occasions. Three were conducted at OSU Cooperative Extension and the last two were at OSU Tulsa. The training sessions consisted of a

Power Point presentation, a practice survey, and a question and answer session. A Power Point created from the NEMS training material for a pilot project in Carter County, Oklahoma was modified to include the changes made for Tulsa County. For this study, researchers adapted the NEMS-S survey to include papaya, mango, guava, pineapple, cactus and tomatillo to accommodate the Latino community and collard greens, mustard greens, turnip greens and kale to accommodate the African-American community. These additions were made so that stores that focused on capturing these populations were not penalized but rewarded for providing healthy options. The additional items were chosen after a researcher from this study visited several local stores to see what items were prevalent in local ethnic grocery stores. Volunteers were provided with a sample survey at the beginning of the presentation to follow the Power Point and take notes as the information was presented. The volunteers received a checklist of items to help them in conducting the surveys. They were also given a packet that had key points about the survey and researchers' contact information in the event there were any questions while conducting the surveys.

After the Power Point presentation, practice surveys were completed at a predetermined store. Researchers were available to answer any questions while the practice surveys were conducted. Immediately following the practice survey, the volunteers met with researchers to discuss any questions or concerns. The volunteers left with several blank surveys so that they could commence once the list of stores was distributed. To limit travel requirements, food outlets were assigned based on home zip codes provided by the volunteers at the training session. Once all five training sessions had been completed the food outlet assignments were distributed to the volunteers. Each volunteer initially received between eight and ten food outlets. The volunteers submitted completed forms to their organization leader or dropped them off at the OSU Extension office or OSU at Tulsa campus where they could pick up blank surveys. Surveyors were to indicate on the survey if the store declined to participate, was no longer open for business, or did

not have food available to purchase. These eliminations resulted in 41 stores where surveys were not completed and 129 stores that were surveyed. There were several reasons the stores were not surveyed: 3 were distribution centers that were not open to the public, 2 were in private buildings that did not allow public access, 1 was out of business, 2 no longer carried food and 33 had managers that refused to participate in the study for various reasons.

Surveys were conducted in person. There are 11 measures (categories of food) with healthy and regular options available. For each measure, availability and price were recorded; there were also several categories that included quality. Volunteers were supplied with paper copies of the survey. See Appendix B for a copy of the survey. Surveyors were instructed to record the non-sale price for each item.

Each store was assigned an 8 digit identification code:

- The first two numbers were for the area, Tulsa county = 72.
- The third number indicates the store type. 1 = convenience store, 2 = grocery store, 3 = dollar-type store, 4 = pharmacy with groceries, and 5 = other.
- The fourth and fifth spaces were used to indicate who surveyed the store. The rater identification was determined by the individuals first and last initial. For example John Smith would be JS.
- The last three digits indicate the store's identification code.

The 8 digit identification code was entered on each page of the survey. On the first page after the code, the date the survey was completed was entered followed by the start and end times for the survey. The surveyor was to estimate how much of the store space was allotted to food and fill in the appropriate bubble. The last part of the cover page is for locally grown food, if available surveyors filled in all the fields that apply.

The first measure of the survey was milk. Preferably, the store brand of milk was surveyed, but if a store brand was not available then the brand that occupied the most shelf space was used. There is a space on the survey to indicate the lowest fat option available. To record shelf space surveyors counted the columns allotted to milk, excluding any empty columns. The shelf space was recorded for lowest fat and whole milk for 4 different sizes; pint, quart, half gallon and gallon. Lastly the prices for the lowest fat and whole milk quart and half gallon were recorded.

The next measure is fresh fruit. If fresh fruit was available then “yes” was marked at the top of the page and if not then “no” was marked and the surveyor moved on to frozen fruit. The survey included a list of 10 fruits to look for. There were preferred options for most of the fruits, if available the price and quality was recorded for these. If unavailable, alternate items could be used. For example, red delicious apples were the preferred option and the alternate was blank for the surveyor to fill in with any other options available (Fuji, Granny Smith etc.). Surveyors indicated if a fruit was available by marking “yes”. The price and whether it was priced by piece, pound, or number of items was then recorded. For example, if an item was 3 for \$1.00 then in the price section the surveyor wrote \$1.00 and in the column labeled # the surveyor would write 3. The surveyor then determined and recorded whether the item was acceptable or unacceptable. After the first 10 items, the available fruits are totaled. There was a section for additional fruits with a list of 4 more fruits. The same protocol was followed for filling out the availability, price, and quality. After that section there was space for surveyors to write in up to 3 additional fruits that were present at the store but not on the previous lists.

The next section of the fruit measure is frozen and canned fruits. The surveyor first indicated whether canned or frozen fruits were available in the store. The surveyor counted the number of the healthy frozen fruits, defined as no sugar added, were available and filled in the appropriate bubble (1, 2, 3+). The availability of the regular option was counted and recorded in the same

manner. The same protocol was followed for canned fruit. To be considered healthy the canned fruit needed to be in water or natural juices.

The third measure is vegetables. The first step was to mark whether fresh vegetables were available or not. There were 10 vegetables for the surveyor to mark the availability, price (per pound or quantity), and if the majority of that item was acceptable or unacceptable. The total number of vegetables available from the first 10 was recorded at the bottom of this section. There were 6 additional fresh vegetables to be marked for availability, price, and quality. The last part of the page had spaces for the surveyor to record 3 other vegetables that were available and not listed above.

The next section for vegetables is frozen and canned. To be considered healthy, frozen vegetables needed to be in water and without sauce; canned vegetables needed to be low-sodium. Surveyors counted the options for each healthy and regular item and fill in the appropriate bubble (1,2,3+).

The fourth measure of the survey is ground beef. The healthier option for ground beef is $\leq 10\%$ fat, $\geq 90\%$ lean and the regular option is 80% lean, 20% fat. The surveyor first marked if ground beef was available in the store or not. The preferred healthy option was ground sirloin which is 10% fat. If this was available the price per pound was recorded. If ground sirloin was not available then the alternate options for the healthier item were lean ground beef with $\leq 10\%$ fat or ground turkey with $\leq 10\%$ fat. After the healthier options were filled in the number of varieties available for lean ground beef were counted. The preferred option for the regular item was standard ground beef with 20% fat, if unavailable the surveyor could write in the % fat.

The fifth measure is hot dogs. The surveyor first recorded whether hot dogs were available in the store or not. For the healthier option the hot dogs need to contain ≤ 9 grams of fat. The preferred item was fat-free that contains 0.5 grams of fat per serving. If this was available, the

brand name was recorded along with the price per package. If it was not, there were three alternate healthy options; the first option was light hot dogs, followed by light beef hot dogs with 1/3 less calories and 50% less fat, the next alternate was turkey dogs with 1/3 less fat and the final alternate item was any package with ≤ 9 grams of fat. The regular option for hot dogs should have ≥ 10 grams of fat. The preferred item was a regular hot dog with ≥ 10 grams of fat. If the preferred item was available the price, ounces of the package, number of hot dogs in the package, grams of fat, and calories per serving were recorded. For alternate items, the brand name, price, ounces of the package, hot dogs per package, grams of fat, and calories per serving were indicated. Soy-based, bratwursts, or other hot dog-like products were not counted.

The sixth measure is frozen dinners. An item had to be between 8 – 11 ounces to be counted for this measure. This measure had two columns with 3 spaces on each side. The left side was for reduced-fat (≤ 9 grams of fat) dinners and the right was for the regular meals. If possible, surveyors tried to use a single company that had both reduced-fat and regular meals. Additionally, surveyors looked for meals of the same type such as a reduced-fat and regular lasagna meal. Surveyor recorded the price, ounces and grams of fat for each meal. Pizza was not included in this measure. The ounces and grams of fat were rounded accordingly and recorded as whole numbers.

The seventh measure is baked goods. Surveyors first marked whether baked goods were available and then if low-fat baked goods with ≤ 3 grams of fat per serving were available. The preferred healthy option was a single whole wheat bagel. If available, the grams of fat, calories, and price were recorded. The first alternate healthy item was a package of plain whole wheat bagels, followed by an English muffin and lastly a low-fat muffin. For any alternates the amount in the package, grams of fat, calories, and price were recorded; if the low-fat muffin was used the type of muffin was also recorded. The regular option was > 3 grams of fat or > 400 calories per serving. The preferred item was a regular muffin and the alternates were regular Danish followed

by other which could be something like a pan dulce. For all of the regular items number in the package, grams of fat, calories, and price were recorded.

Measure eight is beverage which had two different surveys depending on the type of store- convenience or grocery stores. Both surveys included pop and juice. For convenience stores, the healthier pop option was Diet Coke and prices were recorded for both 12 oz. and 20 oz. packages. The alternate healthier item was blank so the surveyor could fill in a brand the store carried. The same was done for the regular options with Coke being the preferred item. The preferred healthier option for juice was 100% juice in a 15.2 oz container. There was a space to indicate if brand- Minute Maid, Tropicana or Other. The alternate was a 14 oz container and the last alternate was a blank space for the surveyor to write in the ounces. The regular options were the same as healthier but for juice drinks instead of 100% juice.

For the grocery store survey, the preferred healthy option was Diet Coke 12 pack of 12 oz. containers with the alternate being a 6 pack of 12 oz. containers. If Diet Coke was not available then the alternate was to write in a brand that the store carried in a 12 pack of 12 oz. or a 6 pack 12 oz. The regular option for pop was Coke and the preferred item was a 12 pack of 12 oz. followed by a 6 pack of 12 oz. An alternate brand was recorded if Coke was not available and the price could be documented for a 12 pack of 12 oz. or a 6 pack of 12 oz. The healthier option for juice was 100% Minute Maid 64 oz. The alternate was 100% Tropicana juice in 64 oz. and the last alternate is was a blank for the surveyor to record the brand with the most shelf space. The regular option was Minute Maid juice drink in a 64 oz. container with the alternate being Tropicana followed by the one with the most shelf space that the surveyor filled in. For all of the beverage sections only the availability and price were recorded.

Measure nine is bread. Surveyors marked if bread was available, if it is not they checked the availability of tortillas. Bread with the most shelf space was surveyed first followed by the

cheapest option. The preferred healthy option was 100% whole wheat bread or other 100% whole grains. If it was available, surveyors recorded the ounces and the price of the loaf. If tortillas were used in lieu of bread, corn tortillas were the preferred option. The regular options were either white bread or flour tortillas. Loaf size and price per loaf were recorded for the regular option. For bread or tortillas, the varieties available were counted and recorded (0, 1, 2, or 3+).

The tenth measure is baked chips. For an item to count as the healthier option it had to have ≤ 3 grams of fat per 1 oz. serving while the regular items needed to have > 3 grams of fat. Surveyors first marked if baked chips were available. The preferred option was baked potato chips. If available the price and ounces of the bag were recorded. For the alternate item surveyors recorded brand name, ounces, and the price. The healthier option section was completed after counting the total number of low fat options available (0, 1, 2, 3+). For the regular option the surveyor selected a bag of comparable size to the healthy option and recorded the ounces, and price. Lays Potato Chips was the preferred brand for the regular option.

Measure eleven is cereal. The surveyor marked if cereal was available in the store and then if healthy cereal was available. For cereal to count as healthy it had to have < 7 grams of sugar per serving. Surveyors were asked to use the smallest box available for the survey. It was preferred if the healthy and regular options were from the same brand, and Cheerios and Honey Nut Cheerios were the preferred items to survey. The healthy and regular options each had a space for the surveyor to write the brand being surveyed and then record the size in ounces and price. If the ounces were not a whole number surveyors were instructed to round accordingly. For the healthy option there was a space to bubble in how many varieties were available with 0, 1, 2, or 3+.

To score the NEMS, 13 categories of foods are evaluated: milk, fruits, frozen and canned fruits, vegetables, frozen and canned vegetables, ground beef, hot dogs, frozen dinners, baked goods, beverages, bread, baked chips, and cereal.¹⁸ An overall NEMS-S score is calculated by adding three sub categories; availability, price and quality. The possible score for each store is -9 to 57. The Healthy Food Availability Index (HFAI) looks at the sub score for availability and a possible score of 0-33 is available. For the availability score, if the healthier option is available then two points are awarded per food item. A store can receive more availability points if there are several varieties of a product available. If the healthier item cost less than the less desirable option then 2 points are awarded. If the less desirable option is less expensive then 1 point is subtracted. For most options, if the healthy and less desirable options are the same price then no points are awarded. Quality points are only awarded for the fruit and vegetable sections. A store is awarded more points, but only up to 3, if a higher percent of the produce is of acceptable quality. The points for each subsection are summed to determine the three sub-scores which are added to determine a total score for each store.

Statistical Analysis

The data were examined using the Statistical Package for the Social Sciences (SPSS version 21). Frequencies were tabulated. Chi Square tests were used to determine if there were differences among the three types of food stores (1=convenience, 2= grocery, 3= other) in whether they sold the foods in the categories of the NEMS-S (Yes=1, No=0). Because beverages are widely available at all types of stores and their prices do not differ they were not included in the results. Also, because baked chips were not widely available so they were not included in the results. Analysis of Variance (ANOVA) was used to compare the mean HFAI scores among the three store types. Stepwise Linear Multiple Regression was conducted to examine the variance explained in the total HFAI scores by the individual items making up the score. This was done to

determine which food item was most predictive of the total score on the HFAI. The statistical significance level was set at $p=.05$ for all analyses.

CHAPTER IV

FINDINGS

Store Characteristics

In all, 107 stores were surveyed. Because the numbers of some stores were limited, the five types of stores: convenience, grocery, dollar-type, pharmacy, and other were condensed into three groups: convenience, grocery and other to make the numbers in each group more comparable. Convenience stores were the most prevalent with 58 surveyed while only 15 grocery stores and 35 other stores were surveyed (Tables 1 and 2).

Type of Store	Frequency
Convenience	58
Grocery	15
Dollar-Type	20
Pharmacy with Groceries	10
Other	4
Total	107

Type of Store Reduced	Frequency
Convenience	58
Grocery	15
Other = Dollar, Pharmacy & Other	34
Total	107

Forty-three stores were inside the Kendall-Whittier (KW) and Eugen Field (EF) neighborhoods and 64 stores were in the surrounding area. For the three store types, there was no significant difference between the numbers of stores in the two areas (Tables 3,4).

Neighborhood	Frequency
Inside KW & EF Zip	43
Adjacent KW & EF Zip	64
Total	107

Type of Store	Inside KW & EF	Adjacent KW & EF	Total
Convenience	22	36	58
Grocery	8	7	15
Other	13	21	34
Total	43	64	107

Not statistically significant, $p=0.534$

Table 5 shows the general availability for the products that were surveyed. General availability only indicates whether a product is found in a store- it does not differentiate between the healthy and regular options. Frozen and canned fruit were the only categories missing general data.

Category	Availability - Yes	Availability - No	Missing	Total
Milk	97	10	0	107
Fresh Fruit	25	82	0	107
Frozen Fruit	16	90	1	107
Canned Fruit	43	62	2	107
Fresh Vegetables	18	89	0	107
Ground Beef	25	82	0	107
Hot Dog	67	40	0	107
Bread	48	59	0	107
Cereal	76	31	0	107

Milk

Ninety-seven of the stores that were surveyed sold milk while ten of the 107 did not. All of the grocery stores (n=15) had milk available but 6 convenience stores and 4 other stores did not have milk. The differences in milk availability were not statistically different by store (Table

6). The lowest fat milk available was skim in eighteen stores, 1% in 5 stores, 2% in 50 stores and 21 stores only carried whole milk (Table 7). There was no statistical difference in fat content of milk by type of store (data not shown). Thirteen surveys did not record the lowest fat milk and these were treated as missing.

Type of Store	Available	Not Available	Total
Convenience	52	6	58
Grocery	15	0	15
Other	30	4	34
Total	97	10	107
Not significant			

Type of Milk	Frequency
Skim	18
1%	5
2%	50
Whole	21
Missing	13
Total	107

Fruits

Of the 107 stores surveyed, 23.4%, or 25 stores, had fresh fruit available (Table 8). Eight of these were convenience stores, 15 were grocery stores, and 2 other stores. The differences in fruit availability among the different types of stores were statistically significant.

Type of Store	Available	Not Available	Total
Convenience	8	50	58
Grocery	15	0	15
Other	2	32	34
Total	25	82	107
Statistically significant at $p \leq 0.001$			

Frozen and Canned Fruit

Of the stores surveyed, 15% (n=16) carried frozen fruit with no sugar added (Table 9).

One convenience store, 13 grocery stores, and 2 other stores sold this healthier option of frozen fruit ($p \leq 0.001$).

Type of Store	Available	Not Available	Total
Convenience	1	56	57
Grocery	13	2	15
Other	2	32	34
Total	16	90	106
Statistically significant at $p \leq 0.001$			

As seen in Table 10, 41% of the stores (n= 43) offered canned fruit in natural juice or water. Convenience stores made up 15 of the 43 stores, 12 were grocery stores, and 16 other stores and this was statistically different at $p < 0.001$.

Type of Store	Available	Not Available	Total
Convenience	15	41	56
Grocery	12	3	15
Other	16	18	34
Total	43	62	105
Statistically significant at $p < 0.001$			

Vegetables

Almost 17% of the stores (n=18) carried fresh vegetables (Table 11). These 18 stores consisted of one convenience store, 15 grocery stores, and 2 other ($p \leq 0.001$).

Type of Store	Available	Not Available	Total
Convenience	1	57	58
Grocery	15	0	15
Other	2	32	34
Total	18	89	107
Statistically significant at $p \leq 0.001$			

Frozen and Canned Vegetables

Stores were surveyed to see if they carried frozen vegetables without added sauce. Table 12 shows that almost 20% of the stores carried the healthier option of frozen vegetables (n=21). No convenience stores carried the healthier option, all of the grocery stores (n=15) and 6 of the other stores did (p<0.001).

Type of Store	Available	Not Available	Total
Convenience	0	58	58
Grocery	15	0	15
Other	6	28	34
Total	21	85	107

Statistically significant at p<0.001

Stores were surveyed for low sodium canned vegetables. Of the 107 stores surveyed 20 stores, or 19.2%, carried low sodium canned vegetables (Table 13). Seven of these stores were convenience, 12 were grocery, and 1 other store (p<0.001).

Type of Store	Available	Not Available	Total
Convenience	7	51	58
Grocery	12	3	15
Other	1	33	34
Total	20	84	107

Statistically significant at p<0.001

Ground Beef

Twenty-five of the stores offered ground beef; 7 of these stores carried ground beef with < 10% fat (Tables 14, 15). One convenience store, 14 grocery stores, and 10 other stores offered ground beef. Only grocery stores offered 90% lean ground beef. The differences in ground beef availability and healthy ground beef option were statistically significant at p<0.001.

Table 14: Chi Square of Ground Beef General Availability			
Type of Store	Available	Not Available	Total
Convenience	1	57	58
Grocery	14	1	15
Other	10	24	34
Total	25	82	107
Statistically significant at $p < 0.001$			

Table 15: Chi Square Availability of lean Ground Beef (<10% fat, 90% lean)			
Type of Store	Available	Not Available	Total
Convenience	0	53	53
Grocery	7	7	14
Other	0	34	34
Total	7	94	101
Statistically significant at $p < 0.001$			

Hotdogs

Eight of the stores surveyed offered a healthier option (≤ 9 grams of fat) for hotdogs (Table 17). One convenience store, seven grocery stores and no other stores had a healthy option available. Of the 107 stores surveyed 67 had hotdogs available (Table 16). The differences in hot dog availability and the healthy hot dog option are statistically significant at $p < 0.001$.

Table 16: Chi Square of Hot Dogs General Availability			
Type of Store	Available	Not Available	Total
Convenience	27	31	58
Grocery	15	0	15
Other	25	9	34
Total	67	40	107
Statistically significant at $p < 0.001$			

Table 17: Chi Square Availability of Hot Dogs Healthier Option			
Type of Store	Available	Not Available	Total
Convenience	1	57	58
Grocery	7	8	15
Other	0	34	34
Total	8	99	107
Statistically significant at $p < 0.001$			

Frozen Dinners

Healthy frozen dinners (≤ 9 grams of fat) were available at 36 stores (Table 18). Two were convenience stores, 11 were grocery stores, and 23 were other stores ($p < 0.001$).

Type of Store	Available	Not Available	Total
Convenience	2	56	58
Grocery	11	4	15
Other	23	11	34
Total	36	71	107

Statistically significant at $p < 0.001$

Baked Goods

To be considered the healthier option, baked goods had to have ≤ 3 grams of fat per serving (Table 19). Only grocery stores offered the healthy option and out of the 15 grocery stores surveyed 10 had the healthy option ($p < 0.001$).

Type of Store	Available	Not Available	Total
Convenience	0	58	58
Grocery	10	5	15
Other	0	34	34
Total	10	97	107

Statistically significant at $p < 0.001$

Bread

Tables 20 and 21 showed bread availability and whole wheat bread availability. Of the stores that were surveyed 66 carried bread and 41 did not ($p = 0.001$). Of those 66, 48 had 100% whole wheat ($p < 0.001$). All 15 of the grocery stores offered bread and 14 of these carried whole wheat. Of 28 convenience stores that supplied bread 13 had whole wheat. Twenty-three of the other stores had bread and 21 of those had whole wheat. Thirty-three of the stores that offered whole wheat offered one variety while 15 of them offered more than 3 options for whole wheat.

Table 20: Chi Square of Bread General Availability			
Type of Store	Available	Not Available	Total
Convenience	28	30	58
Grocery	15	0	15
Other	23	11	34
Total	66	41	107
Statistically significant at p=0.001			

Table 21: Chi Square of 100% Whole Wheat			
Type of Store	Available	Not Available	Total
Convenience	13	45	58
Grocery	14	1	15
Other	21	13	34
Total	48	59	107
Statistically significant at p<0.001			

Cereal

To be classified as the healthy option cereal had to have < 7 grams of sugar. Out of the stores surveyed 83 had cereal and 76 of these had the healthy option (Tables 22-23). All of the grocery stores had cereal available, 67% of the convenience stores had cereal and 83% of the other stores did as well (p=.011).

Table 22: Chi Square of General Cereal Availability			
Type of Store	Available	Not Available	Total
Convenience	39	19	58
Grocery	15	0	15
Other	29	5	34
Total	83	24	107
Statistically significant at p=0.011			

Table 23: Chi Square of Healthy Cereal Availability	
Option	Frequency
Healthy	76
Regular or Not Available	31
Total	107
Statistically significant at p=0.011	

HFAI

The HFAI has a maximum possible score of 33 and a minimum of 0. The overall mean was 8.617 and the standard deviation was 7.722. Table 24 shows the mean and standard error of HFAI for each of the types of stores. Table 25 shows the differences between the store types ($p \leq 0.001$). The mean scores differed significantly with grocery stores having the highest mean HFAI scores followed by other and convenience.

Type of Store	HFAI (mean +/- SE)
Convenience (n=58)	4.862 +/- 0.467 ^a
Grocery (n=15)	25.267 +/- 0.918 ^b
Other (n=34)	7.676 +/- 0.610 ^c

^{a,b,c} different superscripts indicate statistically significant differences, $p < 0.05$

The HFAI score is comprised of each individual item listed in the table below (Table 25). Linear Multiple Regression was used to determine which item was most predictive of the total HFAI score. Fresh vegetable availability explained 76.9% of the variance in the score by itself. Fresh vegetables were followed by frozen meals which contributed 11.2% making up a total of 88.1% of the variance. Fresh fruit availability only explained 1% of the variance ($p < 0.001$).

Predictor	R Square	R Square Change
Fresh Vegetables	0.769	0.769
Frozen Meal	0.881	0.112
Baked Goods	0.931	0.050
Cereal	0.947	0.015
Baked Chips	0.960	0.014
Bread	0.976	0.015
Milk	0.983	0.007
Frozen/Can Fruit	0.987	0.004
Beef	0.990	0.003
CS Beverages	0.992	0.002
GS Beverages	0.995	0.003
Hot Dogs	0.997	0.003
Frozen/Can Vegetables	0.999	0.002
Fresh Fruit	1.000	0.001

CHAPTER V

DISCUSSION

In the broadest definition of “food desert,” the Kendall-Whittier and Eugene Field areas of Tulsa, OK display limited access to healthy food. Within the Kendall-Whittier and Eugene Field areas there were 22 convenience stores and 36 adjacent to the Kendall-Whittier/Eugene Field area. Inside the Kendall-Whittier and Eugene Field area there were 8 grocery stores and 7 were in the surrounding areas. As for the other stores, there were 13 inside the two neighborhoods and 21 outside.

Across all store types, the availability of milk was not significantly different. The scoring for milk made it difficult to determine whether low fat milk was available (a score of 2 points could indicate that skim milk was available or it could indicate that 2% milk was available for 1 point and that the shelf space for 2% and whole milk was equivalent for 1 point). Only 6 convenience stores and 4 other stores did not carry milk. On the other hand, ten measures did vary significantly amongst store types. Fresh fruit was not available in 50 convenience stores and 32 other stores. The results were similar for frozen fruit where only one convenience store and two other stores had it available but 13 of 15 grocery stores did. Healthy canned fruit was not available at 41 convenience stores, 3 grocery stores, and 18 other stores. Fresh vegetables were only available at one convenience store and two other stores while they were available at every grocery store. Healthy frozen vegetables were not available at any convenience stores and 6 other stores had them while all of the grocery stores had them. Healthy canned vegetables were

available at seven (12.5%) convenience stores and one other store carried them while 12 (80%) of the grocery stores had them available. One convenience store and ten other stores had ground beef while one grocery store did not have ground beef. None of the convenience or other stores carried the healthy option of ground beef while almost half of the grocery stores did.

Convenience stores carried hot dogs at 27 of the 58 surveyed, 25 of the other stores and all of the grocery stores offered hot dogs. Only one convenience store and none of the other stores carried the healthy option for hot dogs where almost half of the grocery stores had this option available. For frozen dinners only two convenience stores carried the healthy option and 11 grocery stores and 23 other stores had the healthy option available. There were no healthy options available for baked goods at any of the convenience or other stores but ten (66.7%) of the grocery stores, had a healthy option. Bread was available at 28 convenience stores, 15 grocery stores, and 23 other stores, but healthy options were available at only 13 convenience stores. Grocery stores had healthy bread options at 14 (93.3%) of the stores and 21 of the 23 other stores that carried bread had healthy options. Bread was the only category that had a substantial number of convenience stores carry the healthy option. Cereal was carried at 39 convenience stores, 15 grocery stores and 29 other stores.

There were 6 measures where the grocery stores did not have 100% availability from the stores surveyed. These categories were healthy frozen fruit, healthy canned fruit, healthy canned vegetables, ground beef, frozen dinners, and baked goods. Out of those categories baked goods had the highest number of stores that did not offer this item with almost one-third of the total grocery stores not offering healthy baked goods. This indicates that the majority of the time grocery stores had many options for consumers to choose from and across the board they had plenty of options to help achieve a balanced diet. Convenience stores had the opposite outcome. Three of the categories (fresh fruit, fresh vegetables, and ground beef) were only carried at one convenience store.

The mean HFAI score was 4.86 \pm 0.47 for convenience stores, 25.27 \pm 0.92 for grocery stores, and 7.68 \pm 0.61 for other stores. Similar to Glanz et al.¹⁸, Franco et al.¹⁹ and Chetrick⁸ the HFAI score was higher for grocery stores than convenience stores. The total availability scores for the three previous studies range from 0-27. The score for this study was 0-33 due to the addition of cereal and canned and frozen fruits and vegetables. Glanz et al. had a score of 17.33 \pm 9.43 for grocery stores, 3.54 \pm 2.36 for convenience stores, 10.23 \pm 9.20 for high income neighborhoods and 4.44 \pm 5.71 for low income neighborhoods. Chetrick had results similar to this study in that the mean HFAI score was higher for grocery stores than other stores while the mean score for other stores was higher than mean score for convenience stores. The mean score for grocery stores was 17.9 \pm 9.4, 8.2 \pm 3.0 for convenience stores and 7.3 \pm 5.4 for other stores. For low income neighborhoods the mean score from Franco et al. was 5.20 versus 13.30 for lower income neighborhoods while supermarkets had a mean score of 18.67 and convenience stores had a score of 3.50. In the study conducted by Glanz et al. heart healthy foods were more available in grocery stores than convenience stores indicating that grocery stores have a higher availability than convenience stores.¹⁸ A study that looked at stores before and after a WIC plan was implemented indicated that convenience stores scored lowest for availability and chain supermarkets scored highest.³⁰ The surveys conducted using market basket survey had to eliminate gas stations and dollar-type stores due to lack of availability.²⁷ Since these types of stores had too few items on the list available the prices were not comparable with grocery stores. This is reflected by the chi square analyses when only one category (bread) had the healthy option available in several convenience stores and the other stores provided several categories of healthy options. A large majority of the grocery stores provided healthy options in several categories.

There was no significant difference in the types of stores that were surveyed between Kendall-Whittier and Eugene Field compared to the surrounding area. While the mean HFAI score for grocery stores is adequate, these stores only make up 14% of the stores that were

surveyed. Convenience stores scored the lowest and they made up 54% of the stores that were surveyed. Because convenience stores are more prevalent and may be more accessible to individuals, within the two neighborhoods the access to healthy food is reduced for those who shop there. While there are few grocery stores there are plenty of convenience stores in the area that could carry healthier options to increase the mean HFAI score. Education on healthier options could be provided to store owners to encourage carrying healthier options. The first category that could be addressed is carrying healthy options for frozen canned fruits and vegetables and educating that while fresh produce may spoil frozen produce without added sugar or sauce is a healthy option. Another area that could be addressed is changing out hot dogs for lower fat hot dogs. Almost all of the convenience stores carried the regular option for baked goods but none of them carried a healthy option and this could be a quick switch that would eliminate a substantial amount of calories. A few simple changes for healthy items where the regular items are already carried would be a simple way to increase the mean HFAI of the area. Because this study took place in a lower income area lower income residents may have less access to transportation and may rely heavily on convenience stores for food purchases. If this is the case, a low HFAI score would indicate that consumers have limited access to healthy items which may be contributing to the consumption of foods higher in fat, sodium and sugar.

Linear Multiple Regression was conducted to determine if any of the individual food categories predicted the HFAI score more than other categories. In this case, the availability of fresh vegetables had the greatest impact on total HFAI score explaining over 76% of the variance. This was followed by the availability of healthy frozen dinners which explained 11% of the variance in the HFAI scores. The remaining food items accounted for smaller, but still statistically significant, amounts of variance. These results suggest that the presence or absence of fresh vegetables is a good predictor for the overall access to healthy foods in a store.

Interestingly, the presence of fresh fruit in the store accounted for the smallest amount of variance in the total HFAI score.

CHAPTER VI

CONCLUSION

The definitions for food deserts describe a qualifying area based on distance to certain stores. The stores in this study were not mapped but the low HFAI scores do indicate that there are limited options in the Kendall-Whittier/Eugene Field neighborhoods and the surrounding area. The results showed that there is limited access to healthy options in these two areas. Few stores that were surveyed carried healthy options such as fruit (fresh, canned and frozen), vegetables, (fresh, canned or frozen), ground beef, hot dogs, or baked goods. Every store that was surveyed carried soft drinks. The healthier options were often not available while items high in sugar and fat were almost always available. This data could be used to visit with owners of smaller stores about carrying healthier options. The results could also be used by community leaders concerned with food security to advocate for improved availability and use the data to illustrate the absence of healthy options.

Because there were no significant differences between the two areas that were surveyed it would be interesting for the NEMS-S to be used to compare other areas in Tulsa that differ more in socioeconomic status from the areas that were surveyed in this project. It would be interesting to see if wealthier areas vary significantly in the types of stores that are available and if healthier options are available more often in those stores.

Limitations

Limitations of this study include: seasonal inventory changes, store inventory, difficulty collecting prices, inability to survey all the stores, and rater bias.

Price, availability, and quality of food vary throughout the seasons which could cause variability in the results. To limit this inconsistency surveyors did not record the sale price for products, however in the summer the fresh produce may be lower in price, of better quality, and more available. Many of the surveys were completed in the spring and summertime; however some surveys were not completed until mid-winter. Of the twelve categories surveyed, fruits and vegetables would be the most affected by seasonal variance.

Due to time constraints, a majority of the surveys were conducted on the weekends. Several store owners commented that their inventories were low on weekends because shipments arrived early in the week. It is possible that this could skew the data by not providing an accurate picture of the store's availability.

Surveyors had difficulty obtaining prices for all items since they were not always clearly displayed. If only one item was missing a price the surveyor could verify with a sales associate; however, for multiple missing prices this became a burden for the stores being surveyed. This issue was prevalent at convenience stores as there were often several items missing prices and only one employee. Surveyors were instructed not to interrupt the store's normal business so monopolizing this employee's time was not appropriate. This led to missing data on pricing that inhibited researchers from running statistics related to pricing and this scoring measure was eliminated from this study.

For various reasons, not all stores in the research areas were able to be surveyed. Two chains, one was a convenience store and one was in the "other store" category, did not want researchers in their stores which eliminated 33 of the stores in the area. In addition to the two

chains that declined, several independent stores also declined to give permission to conduct surveys in their stores. Because 41 of stores were not surveyed there may be an incomplete picture of the food environment for the area under question. All of the stores that were not able to be surveyed were either convenience or other type stores. Both types of stores had a low mean HFAI score. If these stores would have been surveyed they likely would have resulted in an even lower HFAI score for the area.

During the training sessions it became apparent that rater bias could be an issue, specifically when rating produce as either acceptable or unacceptable. During the presentation the volunteers were given guidelines to help them determine if a specific fruit and vegetable was of good or poor quality. While conducting practice surveys there was some discrepancy between volunteers about produce quality. The researchers instructed volunteers to score the quality based on if they would personally purchase it or not. While this cleared up most uncertainty there still was variation between surveyors. Once surveys were completed and data was entered it became apparent that the rating of quality was too subjective. Because the rater scoring was not objective enough this data was not used in this study and quality could not be scored.

Future Recommendations

In the future, it would be beneficial to have more concrete ways to evaluate whether produce is of acceptable quality. The instructions given to surveyors were judge quality based on if they would purchase it or not. This is too subjective and because of this, the data was not able to be used. A more concrete approach might be if there is rot or pests present on half of the produce.

The main issue with using NEMS-S is that it is time consuming. This limited how many stores could be surveyed and who was willing to help. One solution to reduce the amount of time required would be to decrease the amount of detail that is recorded. This could be accomplished

by eliminating the details recorded if the original option is not available. For example the hot dogs category has four alternate items for the healthy option instead there could just be one space for the surveyor to mark if there is an option available that has ≤ 9 grams of fat. There may not need to be so many alternate options but instead a place to mark that the alternate is available.

Prices were recorded to help researchers determine if the healthier option was cheaper or more expensive than the regular option which could influence purchasing decisions. However, surveyors recording prices was a common issue store managers had with allowing the surveys to take place. If the surveys were changed to only indicate which option is more expensive, store owners may be more willing to allow their stores to be surveyed. To take it one step further the surveyors could record the price differences but not the specific prices. Both of these options would fulfill the intent of recording prices while easing the manager's concern that prices not be divulged to the public.

One measure that could be removed is soft drinks. Every store that was surveyed in the Tulsa area carried soft drinks and the prices for both healthy and regular options were consistently similar. The purpose of surveying soft drinks was to see if diet pop was cheaper than regular pop and they were usually the same price.

Implications for Field of Nutrition

Being aware of these results is important to a practicing Registered Dietitian as it could help develop a better rapport with clients. It is often easier for clinicians to focus on what is personally familiar and not be aware of the difficulties that other individuals might face. The practitioner may have access to several grocery stores that provide a large variety of options or readily available transportation to travel to stores that provide preferred options. It is important to remember that not everyone has the same access and availability of items and it is best to ask where an individual shops to establish a better idea of what is available before recommendations

are made. A client may become discouraged easily if he or she cannot find or afford what has been recommended and may not return for further advice. Reviewing these results will also provide the professional insight into what is commonly found at different types of stores. It will be best for all involved if the practitioner is able to have prior knowledge and recommend items that are easily accessible and affordable to the client instead of expecting the client to make changes that are not possible and continuing on the same path until the next appointment.

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APPENDICES

Oklahoma State University Institutional Review Board

Date Monday, June 17, 2013 Protocol Expires: 6/16/2014
IRB Application No: HE1138
Proposal Title: Evaluation of the TSET Nutrition and Fitness Initiative (NFI)

Reviewed and Exempt
Processed as: Continuation

Status Recommended by Reviewer(s) **Approved**

Principal Investigator(s)

Deana Hildebrand
315 HES
Stillwater, OK 74078

Nancy Betts
301 HS
Stillwater, OK 74078

Christi Erwin
301 HS
Stillwater, OK 74078

Kevin Fink
180 Colvin Center
Stillwater, OK 74078


Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRS must be submitted for approval with the advisor's signature. The IRS office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRS. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

n The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

The reviewer(s) had these comments:

Enrollment closed, but subjects are still undergoing study procedures. The following measures are added to the protocol: NEMS-S, NEMS-V, CPAT, PARA, SOPARC, SOPLAY, SOFIT. None of these measures involve interaction with humans. Addition of two new co-PI's: Kevin Fink and Christi Erwin

Signature :



Shelia Kennison, Chair, Institutional Review Board

Monday, June 17,
2013 Date

Nutrition Environment Measures Survey (NEMS)

Food Outlet Cover Page



Rater ID:

Cover Page Complete

Nutrition Measures Survey (NEMS)

Cover Page

- Convenience Store (code 1)
- Grocery Store (code 2)
- Dollar-type Store (code 3)
- Pharmacy with groceries (code 4)
- Other _____ (code 5)

Store ID

Date: / /
Month Day Year

Start Time: :

- AM
- PM

End Time: :

- AM
- PM

How much of the store space is for food?

- Low (less than 25%) Moderate (25-50%) Most (>50%)

Does the store offer locally grown foods?

- Yes No

If yes, Mark all that apply.

- Dairy Fruits Vegetables Fresh/frozen meat Baked goods

Comments: _____

General comments: _____

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Nutrition Environment Measures Survey (NEMS)

Measure #1: MILK

Store ID:

Date:

Month Day Year

1. Is MILK available at this store? Yes No

A. Reference Brand

1. Store brand (preferred) yes no

2. Alternate

(most shelf space)

Comments: _____

B. Availability

1. What is the lowest fat milk available (unflavored)? Skim 1% 2% Whole N/A

2. **Shelf Space:** Count the number of rows across each shelf for each container size. If there are multiple shelves of the same container size, add the number of rows on each shelf. Count only what is there. If a row is completely empty, do not count it.

Type	Pint	Quart	Half gallon	Gallon
a. Lowest Fat Milk	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
b. Whole	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

C. Pricing: All items should be same brand

Comments:

1. Whole milk, quart \$. |

2. Whole milk, half-gal. \$. |

3. Lowest Fat milk, quart \$. |

4. Lowest Fat milk, half-gal. \$. |

NOTES:

- Organic milk is measured only if regular milk is unavailable.
- Do not count non-dairy. i.e. soy milk
- Do not count flavored milk (chocolate, strawberry, etc.)

Nutrition Environment Measures Survey (NEMS)

Measure #2: FRUIT

Store ID:

Date:

Month Day Year

Is fresh fruit available?

- Yes – fill in below
- No – Go on to Frozen Fruits

Quality: A- Acceptable, you would buy
 UA- Unacceptable, you would not buy

Availability and Price

1. Is FRESH FRUIT available at this store? Yes No

Fresh Fruits	*Preferred	Available		Price	Unit		Quality		Comments	
		Yes	No	#	pc	lb	A	UA		
1. Bananas		<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/> <input type="text"/> . <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
2. Apples	* <input type="radio"/> Red delicious	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/> <input type="text"/> . <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
Alternate(cheapest) <input type="radio"/> _____										
3. Oranges	* <input type="radio"/> Navel	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/> <input type="text"/> . <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
Alternate (Valencia, <input type="radio"/> _____ etc.)										
4. Grapes	* <input type="radio"/> Red Seedless	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/> <input type="text"/> . <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
Alternate (green) <input type="radio"/> _____										

5. Cantaloupe * Whole \$. _____

Alternate Precut _____

6. Peaches \$. _____

7. Strawberries \$. _____

8. Honeydew Melon \$. _____

Measure Complete

Nutrition Environment Measures Survey (NEMS)

Measure #2: FRUIT

Store ID: ---

Date: / /
 Month Day Year

Fresh Fruits	*Preferred	Available		Price	Unit	Quality	Comments
		Yes	No				

9. Watermelon * Whole \$. _____

1st Alternate pre-cut _____

Last Alternate pre-sliced _____

10. Pears * Anjou \$. _____

11. Total Types: (count # of yes responses)

12. Are other fresh fruits available? Yes No

Fresh Fruits	*Preferred	Available		Price		Unit		Quality		Comments			
		Yes	No	#	pc	lb	A	UA					
13. Papaya		<input type="radio"/>	<input type="radio"/>	\$	<input type="text" value=""/>	.	<input type="text" value=""/>	<input type="text" value=""/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
14. Mango		<input type="radio"/>	<input type="radio"/>	\$	<input type="text" value=""/>	.	<input type="text" value=""/>	<input type="text" value=""/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
15. Guava		<input type="radio"/>	<input type="radio"/>	\$	<input type="text" value=""/>	.	<input type="text" value=""/>	<input type="text" value=""/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
16. Pineapple	* <input type="radio"/> Whole	<input type="radio"/>	<input type="radio"/>	\$	<input type="text" value=""/>	.	<input type="text" value=""/>	<input type="text" value=""/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	Alternate <input type="radio"/> pre-cut												

17. Are other fresh fruits available? Yes No Quality

Yes **Fresh Fruits – Other** A UA

Nutrition Environment Measures Survey (NEMS)

Measure #2: FRUIT

Store ID:

Date:

Month Day Year

Availability and Price – Store Brand not required

1. Are FROZEN FRUITS (no sugar added) available? Yes No

A. Frozen Fruit (no sugar added)

1. # of varieties of frozen fruit (no sugar added) 0 1 2 3+

2. # of varieties of other frozen fruit 0 1 2 3+

1. Are CANNED FRUITS (in natural juice or water) available? Yes No

B. Canned Fruit (in natural juice or water)

1. # of varieties of canned fruit (in natural juice or water) 0 1 2 3+

2. # of varieties of other canned fruit 0 1 2 3+

Nutrition Environment Measures Survey (NEMS)

Measure #3: VEGETABLES

Store ID:

Date:

Month Day Year

Are fresh vegetables available?

Yes – fill in below

No – Go on to next page

Quality: A- Acceptable, you would buy

UA- Unacceptable, you would not buy

Availability and Price

1. Are FRESH VEGETABLES available at this store?

Yes No

Fresh Vegetables	*Preferred	Available		Price	Unit			Quality		Comments
		Yes	No		#	pc	lb	A	UA	

1. Carrots * 1 lb bag \$. _____

1st Alternate Loose _____

Last Alternate Baby, bagged

2. Tomatoes * Loose \$. _____ 1st

Alternate Packaged _____

Last Alternate Cherry tomatoes

3. Sweet Peppers * Green bell \$. _____

Alternate Yellow, red, or orange _____

4. Broccoli * Bunch \$. _____

Alternate Crowns _____

5. Lettuce * Green leaf \$. _____

Alternate Romaine _____

6. Corn * Cheapest \$. _____

7. Celery * Regular \$. _____

Alternate Hearts _____

8. Cucumbers * Regular \$. _____

Alternate Small/baby-size, English _____

Measure Complete

Nutrition Environment Measures Survey (NEMS)

Measure #3: VEGETABLES

Store ID: ---

Date: / /

Month Day Year

Fresh Vegetables	*Preferred	Available		Price	Unit	Quality		Comments
		Yes	No			A	UA	
					# pc lb			

9. Cabbage * Head-Green \$. _____

Alternate Red, napa, bok choy _____

10. Cauliflower *HEAD \$. | _____

11. Total Types: (count # of yes responses) | |

12. Are other fresh vegetables available? Yes No

Fresh Vegetables *Preferred	Available		Price	Unit		Quality	Comments
	Yes	No		#	pc lb		

13. Nopal (Cactus) \$. | _____

14. Tomatillo \$. | _____

15. Collard Greens \$. | _____

16. Mustard Greens \$. | _____

17. Turnip Greens \$. | _____

18. Kale \$. | _____

19. Are other vegetables available? Yes No Quality

Yes	Fresh Vegetables – Other	A	UA
<input type="radio"/>	_____	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	_____	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	_____	<input type="radio"/>	<input type="radio"/>

Measure Complete |

Measure #3: VEGETABLES

Store ID:

Date:

Month Day Year

Availability and Price – Store Brand not required

1. Are FROZEN VEGETABLES (water/ without sauce) available? Yes No

A. Frozen Vegetables (in water/without sauce)

1. # of varieties of frozen vegetables (in water/without sauce) 0 1 2 3+

2. # of varieties of other frozen vegetables 0 1 2 3+

1. Are CANNED VEGETABLES (low-sodium) available? Yes No

B. Canned Vegetables (low-sodium)

1. # of varieties of canned vegetables (low-sodium) 0 1 2 3+

2. # of varieties of regular canned vegetables 0 1 2 3+

Nutrition Environment Measures Survey (NEMS)

Measure #4: GROUND BEEF

Store ID:

Date:

Month Day Year

Availability and Price

1. Is a GROUND BEEF available at this store? Yes No

Item	Available			Price/lb.	Comments
	Yes	No	N/A		

Healthier Option:

1. Lean ground beef, **90% lean**, Yes No, \$. _____
10% fat (Ground Sirloin) _____

Alternate Items:	Yes	No	N/A		
2. Alternate:					
Lean ground beef (<10% fat)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/> . <input type="text"/>	_____
<input type="text"/> % fat					_____
3. Alternate:					
Ground Turkey (≤ 10% fat)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/> . <input type="text"/>	_____
<input type="text"/> % fat					_____

4. # of varieties of lean ground beef (≤ 10% fat) 0 1 2 3+

Regular option:

Item	Available			Price/lb.	Comments
	Yes	No	N/A		
1. Standard ground beef, 80% lean, 20% fat or Ground Chuck	<input type="radio"/>	<input type="radio"/>		\$ <input type="text"/> . <input type="text"/>	

Alternate Item:	Yes	No	N/A	Price/lb.	Comments
2. Standard alternate ground beef, if above is not available <input type="text"/> % fat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/> . <input type="text"/>	

Measure Complete

Nutrition Environment Measures Survey (NEMS)

Measure #5: HOT DOG

Store ID:

Date: / /
Month Day Year

*Try to stay within brand for healthier vs. regular options.

Availability and Price

1. Are HOT DOGS available at this store? Yes No

Item	Available			Price/pkg.	Comments
	Yes	No	N/A		

Healthier Option: (≤ 9 g Fat)

Preferred Item

1. Fat-free brand 0.5 g fat/serving

Yes No N/A \$. |

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Brand name

Alternate Items:

Yes No N/A

2. Light Hot Dogs (turkey/pork)

Yes No N/A \$. |

3. Light beef Hot Dogs,

Yes No N/A \$. |

(about 1/3 less calories 50% less fat)

4. Turkey Hot Dogs

Yes No N/A \$. |

(about 1/3 less fat)

5. Other (≤ 9 g Fat)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Yes No N/A \$. |

<input type="text"/>	oz pkg	<input type="text"/>	Hot
<input type="text"/>		g fat	<input type="text"/>

dogs/pkg

kcal/svg

*** Regular option, next page**

Nutrition Environment Measures Survey (NEMS)

Measure #5: HOT DOG

Store ID:

Date:
Month Day Year

Regular option:

Items: (≥ 10g fat)

Item	Available	Price/pkg.	Comments
	Yes No N/A		

Preferred Item

1. Hot Dogs (regular) ≥ 10 g fat \$. oz pkg Hot dogs/pkg

g fat kcal/svg

2. Alternate Item

\$. oz pkg Hot dogs/pkg

g fat kcal/svg



NOTE:

- Do not count soy-based hot dogs, bratwurst, or other hotdog-like product.

Nutrition Environment Measures Survey (NEMS)

Measure #6: FROZEN DINNERS

Store ID:

Date: / /

Month Day Year

Availability

1. Are single-serving, reduced-fat **FROZEN DINNERS** available? (≤ 9 g fat/8-11 oz.) Yes No

Pricing (All compared items should be *same type of meal.)

Reduced-Fat Dinner	Price/Pkg	Regular Dinner	Price/Pkg
--------------------	-----------	----------------	-----------

(≤ 9 g fat/8-11 oz.)

1. _____ \$. .
 oz g fat

2. _____ \$. .
 oz g fat

3. _____ \$. .
 oz g
 (≥ 9 g fat/8-11 oz.)

1. _____ \$. .
 oz. g fat

2. _____ \$. .
 oz. g fat

3. _____ \$. .
 oz. g fat

*NOTE:

- Look for a single brand that has the same meal in both regular (≥ 10 g fat per 8-11 oz.) and reduced-fat entrees (≤ 9 g fat per 8-11 oz.). For example, look for Lean Cuisine® and Stouffer's® Lasagna, Roast Turkey Breast, and Meatloaf frozen dinners. Write the name of the brand & type of dinner in the space provided. If Lean Cuisine and Stouffer's is not available, use the least expensive alternate brands that have both the reduced fat and regular dinners. Pizza does not count.
- Complete up to 3 frozen dinner pairs
- If there is a limited selection and no alternate pairs available, record the information on what is available.

Nutrition Environment Measures Survey (NEMS)

Measure #7: BAKED GOODS

Store ID:

Date:

Month Day Year

Are baked goods available? Yes – fill in below

No – Go on to next page

Availability & Price

1. Are low-fat BAKED GOODS (excluding bread) available at this store? Yes No

Low-fat baked goods $\leq 3g$ fat/serving

Item	Available		Amt. per package	g fat/ per item	kcal/ per item	Price	Comments
	Yes	No					

Healthier option:

1. Bagel (plain, whole wheat)

Single \$ _____

Alternate Items:

Yes No N/A

2. Package Bagel \$ _____

(plain, whole wheat)

3. English muffin \$ _____

4. Low-fat muffin \$ _____

--	--	--	--	--	--	--	--	--	--

Regular option (>3g fat/serving or >400 Kcal/serving):

1. Regular muffin | | | | | \$ | | _____

Alternate Items	Yes	No	N/A					
2. Regular Danish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/>	\$ <input type="text"/> <input type="text"/>	_____
3. Other (e.g., Pan Dulce)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/>	\$ <input type="text"/> <input type="text"/>	_____

Measure Complete

Nutrition Environment Measures Survey (NEMS)

Measure #8-CS-BEVERAGE

(In general, a convenience store also will sell gasoline)

Store ID: | | | | | |

Date: | | | | | |

Month Day Year

Availability & Price

Healthier option:	Available		Price	Comments
	Yes	No		
1. Diet Coke	12 oz.	<input type="radio"/> <input type="radio"/>	\$ <input type="text"/> <input type="text"/>	_____
	20 oz.	<input type="radio"/> <input type="radio"/>	\$ <input type="text"/> <input type="text"/>	_____
2. Alternate brand of diet soda	Yes	No	N/A	\$ <input type="text"/> <input type="text"/> _____

<input type="text"/>	12 oz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/>	<input type="text"/>	_____
<input type="text"/>	20 oz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/>	<input type="text"/>	_____

Regular option:

Yes No

1. Coke	12 oz.	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/>	<input type="text"/>	_____
	20 oz.	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/>	<input type="text"/>	_____

2. Alternate brand of sugared soda

Yes No N/A

<input type="text"/>	12 oz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/>	<input type="text"/>	_____
<input type="text"/>	20 oz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/>	<input type="text"/>	_____

Healthier option:

1. 100% juice, 15.2 oz.

Yes No

Minute Maid Tropicana Other

\$ _____

Alternate Items:

Yes No N/A

2. 100% juice, 14 oz.

Minute Maid Tropicana Other

\$ _____

3. 100% juice, ____ oz.

Minute Maid Tropicana Other

\$ _____

Regular option:

Yes No

1. Juice Drink, 15.2 oz

Minute Maid Tropicana Other

\$ _____

Alternate Items:

Yes No N/A

2. Juice Drink, 14 oz.

Minute Maid Tropicana Other

\$ _____

3. Juice Drink, ____ oz.

Minute Maid Tropicana Other

\$ _____

Measure Complete

Nutrition Environment Measures Survey (NEMS)

Measure #8-GS:BEVERAGE

Store ID:

Date:
 Month Day Year

[Include Dollar General and similar stores that sell 64 oz. (half-gallon) fruit juice and fruit drinks]

Availability & Price

Healthier option:	Available size	Available			Price	Comments
		Yes	No	N/A		
1. Diet Coke	12 pack 12 oz.	<input type="radio"/>	<input type="radio"/>		\$ <input type="text"/> <input type="text"/> _____	
	6 pack 12 oz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/> <input type="text"/> _____	
2. Alternate brand of diet soda		Yes	No	N/A	\$ <input type="text"/> <input type="text"/> _____	
<input type="text"/>	12 pack 12 oz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/> <input type="text"/> _____	
<input type="text"/>	6 pack 12 oz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$ <input type="text"/> <input type="text"/> _____	

Regular option:

3. Coke 12 pack 12 oz. Yes No N/A \$ _____

Yes No N/A

6 pack 12 oz. \$ _____

4. Alternate brand of sugared soda Yes No N/A

12 pack 12 oz. \$ _____

	6 pack 12 oz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$	<input type="text"/>	<input type="text"/>	_____
--	---------------	-----------------------	-----------------------	-----------------------	----	----------------------	----------------------	-------

Healthier option:

Yes No

1. Minute Maid 100% juice, (64 oz., half gallon)	<input type="radio"/>	<input type="radio"/>	\$	<input type="text"/>	<input type="text"/>	_____
--------------------------------------------------	-----------------------	-----------------------	----	----------------------	----------------------	-------

Alternate Items:

Yes No N/A

2. Tropicana 100% juice, (64 oz, half gallon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$	<input type="text"/>	<input type="text"/>	_____
-----------------------------------------------	-----------------------	-----------------------	-----------------------	----	----------------------	----------------------	-------

3. Other:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$	<input type="text"/>	<input type="text"/>	_____
-----------	-----------------------	-----------------------	-----------------------	----	----------------------	----------------------	-------

Regular option:

Yes No

1. Minute Maid juice drink, (64 oz, half gallon)	<input type="radio"/>	<input type="radio"/>	\$	<input type="text"/>	<input type="text"/>	_____
--------------------------------------------------	-----------------------	-----------------------	----	----------------------	----------------------	-------

Alternate Items:

Yes No N/A

2. Tropicana juice drink, (64 oz, half gallon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$	<input type="text"/>	<input type="text"/>	_____
------------------------------------------------	-----------------------	-----------------------	-----------------------	----	----------------------	----------------------	-------

3. Other:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	\$	<input type="text"/>	<input type="text"/>	_____
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Nutrition Environment Measures Survey (NEMS)

Measure #9: BREAD

Store ID:

Date:

Month Day Year

- **First**, use the bread with the most shelf space.
- **Second**, use the cheapest.
- **Third**, Wheat Bread to White Bread Comparison **OR** Corn Tortilla to Flour Tortilla Comparison
- **BREAD is the preferred Option.**

1. Is BREAD available at this store? Yes No

2. If BREAD is not available, are TORTILLAS? Yes No

Availability & Price

Item	*Preferred	Available			Loaf size (ounces)	Price/loaf	Comments
		Yes	No	N/A			

Healthier Option: Whole grain bread (100% whole wheat bread and other 100% whole grain bread)

1. 100% Whole Wheat Bread * - \$ _____

Alternate Corn Tortillas - \$ _____

2. # of varieties of 100% whole wheat bread
and 100% whole grain (all brands) 0 1 2 3+

Alternate # of varieties of corn tortillas (all brands)

0 1 2 3+

Item	Available			Loaf size (ounces)	Price/loaf	Comments
	Yes	No	N/A			

Regular Option: White bread (bread made with refined flour)

1. White Bread

\$.

Alternate Regular Flour Tortillas

\$.

Nutrition Environment Measures Survey (NEMS)

Measure #10: BAKED CHIPS and SNACKS

Store ID:

Date:

Month Day Year

1. Are BAKED CHIPS available at this store? Yes No

Availability & Price

Low-fat chips $\leq 3g$ fat per 1 oz. serving – Select the brand with the most shelf space and smallest package size

Item	Size (ounces)	Available	Price	Comments
------	------------------	-----------	-------	----------

Healthier Option:

Yes No

1. Baked potato chips oz. Yes No \$ _____

Alternate Items:

Yes No N/A

2. Yes No N/A \$ _____

3. # of varieties of low-fat chips (any brand) 0 1 2 3+

***Regular Option (select most comparable size to healthier option available):**

Size Yes No Price

1. Chips oz. Yes No \$ _____

*If there is no healthier option, select Lays Potato Chips as the brand of potato chips with the most shelf space.

Nutrition Environment Measures Survey (NEMS)

Measure #11: CEREAL

Store ID:

Date:

Month Day Year

Is cereal available? Yes – fill in below
 No – Go on to next page

1. Is healthy CEREAL available at this store? Yes No

Availability & Price

Healthier cereals < 7 g sugar per serving

Item	Available			Size (ounces)	Price	Comments
	Yes	No	N/A			

*Healthier Option: (< 7 g sugar per serving)

1. _____ \$ _____

2. # of varieties of healthier cereals 0 1 2 3+

*Regular Options (≥7g of sugar per serving):

1. _____ \$ _____

*Try to use the same brand if possible.

Measure Complete

Nutrition Environment Measures Survey (NEMS)

Measure #12: READY TO EAT ITEMS

Store ID:

Date:

Month Day Year

1. Are HOT HOLD items available at this store? Yes No
Availability

Hot Food Items	Available		Comments
	Yes	No	
1. Hot Dogs	<input type="radio"/>	<input type="radio"/>	<hr/> <hr/>
2. Sandwiches	<input type="radio"/>	<input type="radio"/>	<hr/> <hr/>
3. Pizza	<input type="radio"/>	<input type="radio"/>	<hr/> <hr/>
4. Other <hr/>	<input type="radio"/>	<input type="radio"/>	<hr/> <hr/>
5. Other <hr/>	<input type="radio"/>	<input type="radio"/>	<hr/> <hr/>

6. Other

○ ○

7. Other

○ ○

Nutrition Environment Measures Survey (NEMS)

Measure #12: READY TO EAT ITEMS

Store ID:

Date:

Month Day Year

1. Are SINGLE-SERVE, REFRIGERATED items sold at this store? Yes No

Availability

Refrigerated Food Items	Available		Comments
	Yes	No	
1. Sandwiches	<input type="radio"/>	<input type="radio"/>	_____

2. Burritos	<input type="radio"/>	<input type="radio"/>	_____

3. Other	<input type="radio"/>	<input type="radio"/>	_____
_____			_____
4. Other	<input type="radio"/>	<input type="radio"/>	_____
_____			_____

5. Is there access to a microwave in the store? Yes No

**** Be sure to mark the ending time on the cover page! ****

Appendix C

Oklahoma State University NEMS–S Scoring Sheet for Stores

StoreID:

Item	Availability of Healthier Item	Avail Total Points	Price**	Price Total Points	Quality	Quality Total Points
Milk	<ul style="list-style-type: none"> • Yes, Skim = 2pt. • If not Skim, but Low-Fat = 1 pt. ----- • Proportion ≥ 50% = 1 pt. (Lowest-Fat to Whole) 	___ / 3	<ul style="list-style-type: none"> • Lower for Lowest-Fat = 2 pt. • Same for Both = 1 pt. • Higher for Lowest-Fat = -1 pt. 	___ / 2		
Fruits	<ul style="list-style-type: none"> • 0 Variety = 0 pt. • < 5 Varieties = 1 pt. • 5 – 9 Varieties = 2 pt. • 10+ Varieties = 3 pt. 	___ / 3			<ul style="list-style-type: none"> • 25-49% = 1 pt. • 50-74% = 2 pt. • 75%+ = 3 pt. 	___ / 3
Frozen and Canned Fruits	<ul style="list-style-type: none"> • Yes, Frozen Fruit (no sug.) = 1 pt. • Yes, Canned Fruit (H2O) = 1 pt. 	___ / 2				
Vegetables	<ul style="list-style-type: none"> • 0 Variety = 0 pts. • < 5 Varieties = 1 pt. • 5 – 9 Varieties = 2 pt. • 10+ Varieties = 3 pt. 	___ / 3			<ul style="list-style-type: none"> • 25-49% = 1 pt. • 50-74% = 2 pt. • 75%+ = 3 pt. 	___ / 3
Frozen and Canned Vegetables	<ul style="list-style-type: none"> • Yes, Frozen Vegetable (H2O) = 1 pt. • Yes, Canned Vegetable (low-sodium) = 1 pt. 	___ / 2				
Ground Beef	<ul style="list-style-type: none"> • Yes, Lean Meat = 2 pt. ----- • 1–2 Varieties ≤ 10% Fat = 1 pt. • ≥ 3 Varieties ≤ 10% Fat = 2 pt. 	___ / 4	<ul style="list-style-type: none"> • Lower for Lean Meat = 2 pt. • Higher for Lean Meat = -1 pt. 	___ / 2		
Hot Dogs	<ul style="list-style-type: none"> • Yes, Fat-Free = 2 pt. ----- • Light, not Fat-Free = 1 pt. 	___ / 2	<ul style="list-style-type: none"> • Lower for Fat-Free or Light = 2 pt. • Higher for Fat-Free or Light = -1 pt. 	___ / 2		
Frozen Dinners	<ul style="list-style-type: none"> • Yes, Reduced-Fat = 2 pt. 	___ / 2	<ul style="list-style-type: none"> • Lower for Reduced-Fat (majority)= 2 pt. • Higher for Reduced-Fat = -1 pt. 	___ / 2		
Baked Goods	<ul style="list-style-type: none"> • Yes, Low-Fat Items = 2 pt. 	___ / 2	<ul style="list-style-type: none"> • Lower for Low-Fat (per piece) = 2 pt. • Higher for Low-Fat (per piece) = -1 pt. 	___ / 2		

Beverages	<ul style="list-style-type: none"> • Yes, Diet Soda = 1 pt. ----- • Yes, 100% Juice = 1 pt. 	___ / 2	<ul style="list-style-type: none"> • Lower for Diet Soda = 2 pt. ----- • Higher for 100% Juice = -1 pt. 	___ / 2			
Bread	<ul style="list-style-type: none"> • Yes, Whole Grain = 2 pt. ----- • >2 Varieties Whole Wheat = 1 pt. 	___ / 3	<ul style="list-style-type: none"> • Lower for Whole Wheat = 2 pt. • Higher for Whole Wheat = -1 pt. 	___ / 2			
Baked Chips	<ul style="list-style-type: none"> • Yes, Baked Chips = 2 pt. ----- • >2 Varieties Baked Chips = 1 pt. 	___ / 3	<ul style="list-style-type: none"> • Lower for Baked Chips = 2 pt. • Higher for Baked Chips = -1 pt. 	___ / 2			
Cereal	<ul style="list-style-type: none"> • Yes, Healthier Cereal = 2 pt. 	___ / 2	<ul style="list-style-type: none"> • Lower for Healthier Cereal (per box) = 2 pt. • Higher for Healthier Cereal (per box) = -1 pt. 	___ / 2			
	Avail. Subtotal (0 – 33) =	___ / 33		Price Subtotal (-9 – 18) =	___ / 18	Quality Subtotal (0 – 6) =	___ / 6
Overall NEMS-S Score =							

* Overall NEMS-S Score = Availability + Price + Quality ((NEMS–S Score = -9 – 57))

Healthy Food Availability Index = Availability (0 – 33)

** For scoring price, if price is equal for healthy and unhealthy options, no points are granted.

*Modified 12/13/12

VITA

Emily Michelle Winden

Candidate for the Degree of

Master of Science

Thesis: ASSESSING THE AVAILABILITY AND ACCESS TO HEALTHY FOODS
IN TULSA, OKLAHOMA

Major Field: Nutritional Sciences

Biographical:

Education:

Completed the requirements for the Master of Science in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in July, 2014.

Completed the requirements for the Bachelor of Science in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in 2012.

Experience:

Graduate Research Assistant
Native Youth Preventing Diabetes
Union Public Schools
Cancer Treatment Centers of America

Professional Memberships:

American Dietetic Association
Oklahoma Dietetic Association