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The Ability to Purchase Organic Food Items among Participants of the Women, Infants, and Children Program in Los Angeles County

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Abstract

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MA, University of Phoenix, 2005

BS, Arizona State University, 2003

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

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Abstract

Lack of accessibility to healthy foods is a factor associated with the increase in obesity, diabetes, and other negative health consequences. While programs such as WIC (Women, Infants, and Children) provide supplemental nutritional access to healthy foods, few organic food items are included in the WIC authorized food list. Government programs and policy makers that provide to the most vulnerable populations are concerned about equal availability of healthy foods. The purpose of this study was to compare variability and cost of organic food items in 24 large chain grocery stores located in high- and low-income areas. The theoretical concepts of social production of disease and political economy of health guided the study. The study used a quantitative research design to investigate the relationship between neighborhood income level and the consumer nutrition environment. Organic food scores were compared by neighborhood income level using t test and ANOVA. There were significant differences in availability and variability scores of healthy organic foods between high- and low-income neighborhood stores. Organic food items, specifically 15% fat content ground beef, peanut butter, apple juice, and eggs were priced significantly higher than conventional items ($p < 0.05$). Pricing of organic foods varied and no significant pricing trends were noted between neighborhood income levels. This study may contribute to social change by enhancing the conversation on organic food availability and affordability. Social change may be promoted through identification of the need to expand WIC authorization of organic food items and increasing produce voucher amount to allow WIC participants to purchase higher amounts of organic produce.

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Dedication

I dedicate this dissertation to my grandmother, children, and husband who showed me what unconditional love is and whose faith gave me the strength to believe that I could realize my dreams. I also dedicate this dissertation to Dr. Stadtlander and the “Dissertation Sisters” for their steadfast faith and support during this journey.

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Chapter 1: Introduction to the Study

Introduction

Lack of accessibility to healthy foods is a factor associated with the increase in obesity, diabetes, and other negative health consequences. Presently, there are a variety of government programs and policies in place to provide healthy foods to the most vulnerable populations: pregnant women, infants, and young children. The Women, Infants, and Children (WIC) program was designed as a special supplemental nutrition initiative to promote health for pregnant, breastfeeding, and postpartum women, infants, and children up to the age of five (United States Department of Agriculture [USDA], 2014a). The WIC program was designed to promote overall health and reduce the risk of negative health outcomes in pregnant women, postpartum women, infants, and children. During the 2013 fiscal year, WIC supported an average 8.6 million recipients per month (USDA, 2014a). The state of California has the largest portion of WIC participants in the United States at 17% (Johnson et al., 2013) or 1.4 million participants (California Department of Public Health [CDPH], 2014). Los Angeles County accounts for 467,000, or one-third, of all Californian WIC recipients. In 2014, WIC served nearly 600,000 individuals in Los Angeles County or approximately 67% of all infants and about half of all children ages one to five each month (Public Health Foundation Enterprises WIC Program, 2015).

Eligibility for the WIC program is based on income, risk for poor nutrition, and demographic categorization as a pregnant, breastfeeding, or postpartum woman; an infant up to the age of one year; or a child of one year through the fifth birthday. Income eligibility is set at 185% of the poverty level. In Los Angeles County this is less than or equal to $44,123 per annum for a family of four from April 1, 2015 until June 30, 2016 (CDPH, 2015; U.S. Census Bureau, 2015). Some examples of the categories that make up risk for poor nutrition include being underweight, overweight, failing to meet USDA dietary guidelines, or having inappropriate weight gain. Of the approved recipients in the United States for 2012, 26% were overweight, 11% had inappropriate weight gain, and 50% had inappropriate food practices (Johnson et al., 2013).

Families (pregnant women, breast feeding women, and children under the age of five) that meet these qualifications receive at no charge authorized supplemental food items such as milk, cereal, and baby food from participating food vendors (USDA, 2014b). Typically, these supplements are distributed as vouchers or an Electronic Benefits Transfer (EBT) card. For produce, a voucher is given for a specific dollar amount, and if the participant wishes to buy produce over the voucher amount it must be paid out of pocket. The list of authorized food items and the amount of voucher checks are determined by WIC with each state being provided final say on the specific items, and variations, that the program will include. There are limitations on the types of foods WIC participants are permitted to purchase. For example, WIC only authorizes some organic items. If a WIC recipient wishes to purchase unauthorized organic food it must be paid for wholly out of pocket. While WIC does approve organic produce, the voucher provided covers a set dollar amount that frequently does not cover the same number and variety of organic items as it would conventional items.

Organic foods have been shown to reduce exposure to pesticides that have been linked to cognitive impairment and other negative health outcomes in children (Bouchard et al., 2011). Specific negative health consequences include a wide range of neurodevelopmental impairments, including lower IQ (Bouchard et al., 2011; Engel et al., 2011; Furlong, Engel, Barr, & Wolff, 2014; Shelton et al., 2014); reproductive, endocrine, immune, and respiratory system disorders (Liu & Schelar, 2012); and cancer in children (American College of Obstetricians and Gynecologists [ACOG], 2013). The primary basis of this elevated risk is that children are more susceptible to pesticide neurotoxicity because the brain is still developing. Children are therefore exposed to higher doses of pesticides relative to body weight, engage in lower levels of physical activity, and have fewer enzymes that detoxify activated forms of some pesticides than adults (Bouchard et al., 2011). Developing neonates and infants are believed to be of higher susceptibility to pesticide exposure because of the ready transmission of some pesticides through the placenta, and because the underdeveloped metabolic system does not process and excrete these chemicals as effectively (Furlong et al., 2014). Additionally, meat products cultivated using conventional husbandry practices have higher frequencies and types of antibiotic resistant bacteria than their organic counterparts (Brandt et al., 2011; Forman et al., 2012; Huber et al., 2011; Palupi et al., 2012; Smith-Spangler et al., 2012). Consumers are becoming increasingly aware of the health benefits of organic foods, and consumer studies have shown that there is increased interest in purchasing organic food items (Aschemann-Witzel, Maroschek, & Hamm, 2013). Some researchers have suggested that the increased consumer demand for organic food items is due to the growing perception that these products provide a healthier food choice (Aschemann-Witzel, Maroschek, & Hamm, 2013; Capuano, Boerrigter-Eenling, Veer, & Ruth, 2013; Jensen, Jorgensen, Halekoh, Olesen, & Lauridsen, 2012).

The literature has demonstrated health benefits of organic versus conventional in the following food categories: fruits, vegetables, fresh meat, and bovine milk (Brandt, Leifert, Sanderson, & Seal, 2011; Forman et al., 2012; Huber, Rembiałkowska, Średnicka, Bügel, & van de Vijver, 2011; Palupi, Jayanegara, Ploeger, & Kahl, 2012; Smith-Spangler et al., 2012). Based on the scientific evidence regarding pesticide exposure in children and threats to their health, the American Academy of Pediatrics (APA) issued guidelines for pediatricians regarding this issue, and suggested that efforts should be made to limit children's exposure to pesticides as much as possible (Roberts et al., 2012). Similar recommendations have been provided by the American College of Obstetrics and Gynecology (ACOG), to counsel prenatal and preconception patients to decrease their exposure to pesticides that can help decrease the risk of negative health consequences for their unborn children (Sathyanarayana, Focareta, Dailey, & Buchanan, 2012). Both the APA and the ACOG suggest purchasing and consuming organic produce when possible, and the ACOG further suggests focusing on the "Dirty Dozen," a list of the twelve products with the highest risk of pesticide exposure provided by Environmental Working Group (EWG, 2015). The Dirty Dozen for 2015 ranked by pesticide load, including apples, peaches, nectarines, strawberries, grapes, celery, spinach, sweet bell peppers, cucumbers, cherry tomatoes, snap peas, potatoes, and hot peppers.

While the health benefits of organic food items have been demonstrated (Sathyanarayana et al., 2012), WIC limits what organic food items it authorizes. The dollar amount authorized for produce represents a barrier to purchasing exclusively organic produce items. Access to organic food items is not only a barrier for WIC recipients, but also for all consumers. The current body of literature suggests not all consumers have equal access to organic food items and, therefore, may not have equal ability to consume them daily as part of a nutritious diet (Curl et al., 2013). Organic food is generally more expensive, with the average cost difference of 10%-40% more than similar conventional food items (Forman et al., 2012). WIC recipients are given $10 per month for pregnant and breast feeding women and $6 per month for children ages 1-4 to spend on fruits and vegetables, and choices have to be made to maximize spending ability for healthy foods (CDPH, 2013).

Having equal access to healthy foods is a public health concern and there are ongoing programs and initiatives such as the Supplemental Nutrition Assistance Program (SNAP**),** WIC program, Office of Health Start, and Nutrition for Seniors designed to increase access to healthy foods for all Americans (USDA, 2015). The WIC program has the ability to make a significant impact on those it serves. One area of focus for the WIC program has been the availability of healthy food items that promote overall health and decrease the prevalence of obesity in pregnant women, infants, and children. The food items authorized by WIC align with the USDA dietary guidelines established for all Americans to help promote the consumption of nutritionally dense foods.

The California WIC program has agreements with approved food retail vendors regarding the availability and reimbursement amount of WIC items (CDPH, 2014). Approved vendors are required to carry all authorized food items to ensure consumers have access and availability of food items. WIC has also set a reimbursement amount it pays for WIC voucher items that reduces the price elasticity of an item to ensure affordability. Additionally, CDPH provides an updated list, of all of the approved food retail vendors in California, with 1097 available in Los Angeles county alone (CDPH, 2015).

While there is a system in place to reduce price elasticity for WIC approved items regardless of the income level of the population where the food retailer is located, a similar system does not exist for WIC non-approved items. The literature has shown that the primary barrier to eating a healthy diet is the cost of nutritious food items (Drewnowski, 2010; Monsivais et al., 2012). Large grocery stores have been found to offer the largest variety of healthy food items at the lowest price (Drewnowski et al., 2013; Glanz, Sallis, Saelens, & Frank, 2007; Morland, Diez Roux, & Wing, 2006). However, even at large grocery stores, differences in cost have been observed between nutritious and less-nutritious foods (Drewnowski et al., 2012), and significant price differences have been found between organic and non-organic food items (Capuano et al., 2013; Drewnowski et al., 2012). The consequence for consumers with limited budgets is a decreased ability to purchase organic food items while maximizing purchase of total healthy foods.

Providing equal access to healthy foods, including organic options, to all consumers regardless of socioeconomics has been an on-going challenge for public health efforts. Exploring what organic foods are available in large grocery stores located in high-income neighborhoods and comparing to large chain grocery stores in low-income neighborhoods may provide insight into why those who live in low-income areas have a higher risk of obesity and what the additional cost is to buy organic food items. In my study, I compared organic food cost and availability between high and low-income areas to identify if a difference of cost and variability of organic food items exists between areas of varying socioeconomic levels. I also sought to identify the variance of the price elasticity. This study of the additional cost of organic food items for WIC recipients may help guide public health initiatives and possibly support a grass roots effort to encourage WIC to expand the number and types of organic food covered in addition to the amount of money provided to purchase organic produce.

Problem Statement

Research has shown that there are barriers to the availability of healthy food items for consumers living in areas of lower socioeconomic status. Researchers are currently exploring if there is a significant difference in the cost and availability of healthy food items across high and low socioeconomic areas, and if availability is a contributor to the high rate of obesity and diet-related health risks in lower socioeconomic areas (Drewnowski, 2010; Monsivais et al., 2012). Looking for possible causative relationships, researchers have explored access to healthy food items, the differences in cost between various food sellers, and the purchasing habits of those in lower socioeconomic areas (Appelhans et al., 2012; Bruening, MacLehose, Loth, Story, & Neumark-Sztainer, 2012; Jacquier, Bonthoux, Baciu, & Ruffieux, 2012; Larson, Story, & Nelson, 2009).

The existing literature generally agrees that people who live “food deserts” in dense urban centers and rural areas are at higher risk of limited access to a variety of healthy and affordable food (Dutko, Ver Ploeg, & Farrigan, 2012). The food deserts in urban centers have reduced availability of healthier food options such as fruits and vegetables, and foods at small food retailers found in food deserts are sold at a higher mean cost than larger grocery stores in other urban areas. However, there is a lack of consensus as to whether barriers exist to accessing health food items in typical urban areas, and studies have looked primarily at consumer proximity to grocery retailers as the variable of measurement to determine access (Drewnowski, Aggarwal, Hurvitz, Monsivais, & Moudon, 2012; Dutko et al., 2012; Moore, Roux, Nettleton, & Jacobs, 2008).

In regards to food item pricing, differences in food item costs have been observed for healthy food items, but the significance of the cost difference between food items or categories has varied, with some studies suggesting a modest difference and other studies suggesting a more moderate difference (Drewnowski et al., 2012). The studies to date are limited by the lack of consistency in the literature on what healthy food items, food item categories, or food baskets to study. Studies have focused on a variety of topics including the availability of fruits and vegetables, the amount of fat or fiber in the food items, the availability of organic foods, and specific diet compositions. While researchers were successful in including food items that meet qualifications of being healthy, there has not been an agreement on a standard food basket to use as a metric. The lack of a standardized definition of study variables and food item index has been and continues to be a significant barrier in the evaluation of this research topic. Despite these limitations, the body of research does agree that healthier food items are generally more expensive. There has been one instrument, the Nutritional Environment Measures Survey in Stores (NEMS-S), which has been used in a variety of research studies including those focused on the WIC participant population (Andreyeva, Luedicke, Middleton, Long, & Schwartz, 2012; Franco, Diez Roux, Glass, Caballero, & Brancati, 2008; Krukowski, West, Harvey-Berino, & Prewitt, 2010). The NEMS-S instrument was developed to explore the availability, price, and quality of healthy food items in retail food vendor environments utilizing ten food item categories (Glanz et al., 2007) and has been used in a variety of healthy food studies in rural and urban areas, and in areas of high and low-income.

To understand barriers to healthy food access and item price differences, researchers have explored the shopping habits of food retail consumers. The results of those studies have indicated that low-income individuals are influenced in their grocery store purchases by taste, price, and accessibility of food items (Drewnowski et al., 2012). Findings of both observational and telephone survey models are mixed as to whether socioeconomics is directly related to the overall health of an individual’s diet. Some studies suggest high-income consumers purchase healthier food items than low-income shoppers, but studies mixed on the percentage of healthy food items purchased across socioeconomic levels. However, there is a stronger association for both overall healthier food items and organic purchases for consumers with higher levels of education (Drewnowski et al., 2012; Capuano et al., 2013). A current research question being explored is: Does everyone have equal access to organic food and the equal ability to make purchasing choices between organic and non-organic food items? At present, research shows that individuals with better access to healthy food items tend to have healthier diets (Capuano et al., 2013). It is possible that not all communities have equitable access to organic food items and the literature indicates that low-income neighborhoods often have limited access to large grocery stores (Powell, Slater, Mirtcheva, Bao, & Chaloupka, 2007).

At this time, no study has demonstrated whether organic food items are offered in the same variety and price points at large chain grocery food sellers across socioeconomic regions. That is, even though the prices can vary *across* grocery store chains, no known study has looked for differences *within* grocery store chains regarding organic food item variability or pricing in both high and low socioeconomic areas. My use of Los Angeles County as a study location provided a unique opportunity to explore access to organic food items, and to the service of WIC in a locale that is not only the leading agricultural producer in the United States, but also has a largest WIC participation in the country. Hence, this research contributes to the gap in understanding by exploring if a difference exists in both food item pricing and variability of WIC food list organic items in large grocery store chains that service both high and low-income neighborhoods.

Purpose of the Study

The purpose of this study was to compare food variability and cost of organic food items in large chain grocery stores located in high and low-income areas in Los Angeles County, CA. I used NEMS-S to assess differences between stores. The NEMS-S tool provided a methodology to collect and analyze data regarding variability and price. The results of this study provided insight into the nutritional environments of WIC and non-WIC consumers who shop at large grocery stores located in high and low-income areas.

Research Questions

The research questions and hypotheses in this study were chosen after a careful and comprehensive review of the research literature regarding organic food availability and cost, food deserts, socioeconomics, obesity demographics, nutritional environment, pesticides, health benefits of organic foods, negative health consequences of pesticides in food, and barriers to nutritionally dense foods. I discuss the methodology employed for this study in detail in Chapter 3.

The overarching question for this study was: How does the cost and variability of the WIC food basket (of organic vs. non-organic foods) differ in large chain grocery stores across socioeconomic areas (high and low) of Los Angeles County, CA? This overarching question led me to construct the following research questions (RQs) and associated hypotheses:

RQ 1: Do large chain grocery stores located in low-income neighborhoods have the same organic food availability as large chain grocery stores located in high-income neighborhoods?

H1$_0$: Large chain grocery stores located in low- income neighborhoods, defined as census tracts with income levels less than or equal to $44,123 per annum, will have the same organic food availability as large chain grocery stores located in high-income neighborhoods, as defined by census tracts with income levels of greater than or equal to $95,400 per annum.

H1$_a$: Large chain grocery stores located in low-income neighborhoods, defined as census tracts with income level less than or equal to $44,123 per annum, will not have the same organic food availability as defined by the WIC food basket, as large chain grocery stores located in high-income neighborhoods, as defined by census tracts with income levels of greater than or equal to $95,400 per annum.

RQ 2: Do large chain grocery stores located in low-income neighborhoods have the same price points for organic and non-organic food items included on the WIC food basket as large chain grocery stores located in high-income neighborhoods?

H2$_0$: Large chain grocery stores located in low-income neighborhoods, defined as census tracts with income level less than or equal to $44,123 per annum, will have the same price points for organic and non-organic food items, as defined by the WIC food basket and measured by the

NEMS-S, as large chain grocery stores located in high-income neighborhoods, as defined by census tracts with income levels of greater than or equal to $95,400 per annum.

$H2_a$: Large chain grocery stores located in low-income neighborhoods, defined as census tracts with income level less than or equal to $44,123 per annum, will not have the same price points for organic and non-organic food items, as defined by the WIC food basket and measured by the NEMS-S, as large chain grocery stores located in high-income neighborhoods, as defined by census tracts with income levels of greater than or equal to $95,400 per annum.

RQ 3: Is there the same variability of organic and non-organic food items, as defined by the WIC food basket, available at both high and low-income neighborhood large chain grocery stores?

$H3_0$: Large chain grocery stores located in low-income neighborhoods, defined as census tracts with income level less than or equal to $44,123 per annum, will have the same food item variability for organic and non-organic food items, as high-income levels defined by census tracts of greater than or equal to $95,400 per annum.

$H3_a$: Large chain grocery stores located in low- income neighborhoods, defined as census tracts with income level less than or equal to $44,123 per annum, will not have the same food item variability for organic and non-organic food items, as high-income levels defined by census tracts of greater than or equal to $95,400 per annum.

Theoretical Framework

I used the theoretical concepts of the social production of disease and the political economy of health (SPDPEH) as conceptual models to explore how economic and political determinants of health and disease create obstacles inhibiting individuals from living healthy lives (Krieger, 2001). Together, they also provided a lens to explore the complex nature of how social factors might increase risk for poor health outcomes, such as obesity, and negative health consequences associated with pesticide exposure.

A disparity in the distribution, variability, and affordability of healthy foods creates an accessibility barrier. The model of community nutrition environments provides the tool to measure components of the nutrition environment and includes four environmental variables: community, organizational, consumer, and information (Glanz, Sallis, Saelens, & Frank, 2005). Each of these four environmental variables also aligns with the social factors of the SPDPEH. The community nutrition environment model is included in the framework in the development of the Nutritional Environment Measures Survey (NEMS-S). This instrument was used in a variety of studies focused on exploring disparities in access to healthy foods in food retail environments. The blending of SPDPEH as the theoretical framework with the model of community nutrition environments provided me the lens and tools to explore my research questions. In Chapter 2 I will explain how I used these two theoretical frameworks.

The focus of this study was based on the consumer nutrition environment section of the model of community environment, and I specifically explored the variability and cost of healthy organic foods. The consumer food environment includes the food items consumers come across and the areas where they purchase food items (Glanz et al., 2007). This provides the framework to investigate the consumer's experience regarding availability, variability, and price of organic food items. For the needs of this study, I customized the NEMS-S tool, designed to assess the consumer food environment and has been found to be a reliable instrument (Andreyeva et al., 2011; Glanz et al., 2007).

Nature of the Study

This study's research design was quantitative in nature. The theoretical framework and a comprehensive review of the literature including research on organic food availability and cost, food deserts, socioeconomics, obesity demographics, nutritional environment, pesticides, health benefits of organic foods, negative health consequences of pesticides in food, and barriers to nutritionally dense foods shaped and directed the design of this study. To gain insight into food availability within the nutrition food environment of large chain grocery stores, I needed to compare the availability, variability, and price of healthy organic foods items located in high and low-income areas of Los Angeles County, CA. I surveyed large chain grocery stores during a one-month period between the hours of 9 a.m. and 4 p.m. in September 2015. I used the NEMS-S instrument to survey the WIC food basket in stores located in both high- and low-income areas. The independent variable was socioeconomic status: high- and low-income. The dependent variables included organic food availability, variability, and price. To analyze the data collected during this study, I used the *t* test, chi-square test, and Levene's test. In Chapter 3, I present a detailed methodology.

Definitions

High-income area: For the purpose of this study, high-income area was a census tract whose mean income level is great than or equal to 400% of Federal poverty level (FPL) or is great than or equal to $95,400 per annum in Los Angeles County, CA (U.S. Census Bureau, 2015; CDPH, 2011).

Low-income area: For the purpose of this study, low-income area was a census tract whose mean income level of less than 185% of the FPL or less than or equal to $44,123 per annum in Los Angeles County, CA (U.S. Census Bureau, 2015; CDPH, 2011).

WIC program: For the purpose of this study WIC, program was defined as the Special Supplemental Nutrition Program for Women, Infants, and Children (California Legislative Information, 2012).

Recipient: For the purpose of this study, recipient was defined as an individual in one of the following demographic groups: low-income pregnant women, low-income post-partum and lactating women, and low-income infants and children under five years of age who have been evaluated as being at nutritional risk by a medical professional based on criteria established by the California state department (California Legislative Information, 2012).

Voucher: A check that was limited as to value, food type, and food quantity, and has a limited period of validity (California Legislative Information, 2012).

Nutrition environment: Nutrition environment included the variables that interact and influence the dietary choices and behaviors of individuals (Glanz et al., 2007).

Consumer nutrition environment: The food items customers come across and the areas where they purchase food items (Glanz et al., 2007).

Large grocery chain store: For the purpose of this study, a large grocery chain store was defined as a food retailer with: annual sales less than $5 million (An & Sturm, 2012); a recognized chain name; multiple stores that range from 40,000 to 80,000 square feet; additional services such as a delicatessen, pharmacy, and general merchandise (Martin et al., 2014); more than 50 employees (Franco et al., 2008).

Food availability: The physical presence of the food item in the grocery store at the time of survey (Glanz et al., 2007).

Variability: The physical presence of more than one variation of the same food item available for purchase at the time of survey.

Price: The regular, non-sales, cost of a food item (Glanz et al., 2007).

Conventional food item: all non-certified organic food items (USDA, 2014a) Examples of conventional food items would be non-organic whole milk and white bread (Glanz et al., 2008).

Organic: food items which are labeled as “organic” or “certified organic” (USDA, 2014b).

Healthy food items: Food products that are nutrient rich and meet the 2010 USDA Dietary Guidelines by reducing fat, sugar, calories, sodium, or saturated fat and that contain whole grains. Examples of healthy food items would be skim milk and whole wheat bread (Glanz et al., 2008).

Assumptions

I assumed that the large chain grocery stores under the same corporate umbrella are run and operated with similar policies, layout, and product placement. I also assumed that the vendor list provided by WIC was complete, current, and included all WIC-approved vendors located in Los Angeles County, CA. These assumptions were required because I sought to survey only large chain grocery stores and not grocery stores under the same corporate chain or a variety of food retailers. Further, I assumed that the NEMS-S instrument was not only valid and reliable, but was also able to customize without compromising the rigor of the tool. Lastly, I assumed that all food items labeled as organic are, in fact, certified organic, unless otherwise noted.

Scope of Delimitations

I surveyed large chain grocery stores that were included in the Approved WIC vendor list and were located in either high- or low-income areas of Los Angeles County, CA. I chose this specific focus because large grocery stores provide the widest availability of healthy food items at the lowest price. I chose chain grocery stores in order to provide a larger sample of stores operating in high- and low-income areas. Additionally, my inclusion of both large grocery stores and those that operate as a chain provided a more comprehensive picture of the consumer nutrient environment. Exploring large chain grocery stores through Los Angeles County, CA allowed the results to be generalized to represent all of Los Angeles County. In using the community nutrition environments model, I studied only the consumer nutrition environment components because they encompass food availability, variability, and price in food retailers.

Limitations

The main limitation of this study was the ability to generalize the results to large chain grocery stores beyond the boundaries of Los Angeles County, CA. Another limitation was the types and amounts of foods included on the NEMS-S instrument that included samples of those authorized by WIC and those with detectable levels of pesticides. The results may have limited the usability of the findings to the specific foods or food groups studied. Yet another limitation was the food item availability, variability, and price of organic foods sold at other food retailers located in the high- and low-income census tracts being surveyed. Lastly, my study did not include a complete representation of all the large chain grocery stores located in the geographical areas surveyed. To address these limitations, I surveyed a random sample of an equal number of large chain grocery stores in high- and low-income areas.

Significance

At the heart of this study is the desire to better understand how food availability and cost may correlate to socioeconomic disparities and barriers to health. This study explored if there were significant differences in food item variability and price across socioeconomic areas within the same grocery store chains. I found that there was disparity in food item price and variability between socioeconomic areas. Using on these finding, policies may be implemented to eliminate this disparity. I determined there is a socioeconomic barrier in the availability and pricing of organic healthy food items, though this barrier is not universal. Additional factors, which may be associated or correlated with these phenomena, can now be evaluated. This study helped fill an existing gap in the literature and provided insight on possible barriers in food item pricing and variability in the grocery store environment. It thus provides a foundation for subsequent research to build upon. Ultimately, this study identified a need to evaluate further how organic food items are distributed and priced in varying socioeconomic areas. With 60% of babies born in Los Angeles County qualifying for WIC, there is a large population of vulnerable children and families further supported by authorizing the purchase of a wider range of organic food items and increasing the voucher amount for organic produce.

Summary and Transition

The state of California has the highest percentage of WIC recipients of any state in the United States (PHFE WIC, 2015). Understanding the variables in the environment that contribute to pesticide exposure from food, organic food availability, and cost of organic food items is vital for public health efforts. Food availability in low-income areas is less than those of high-income areas (Andreyeva et al., 2012; Franco et al., 2008; Glanz et al., 2007; Powell et al., 2007), and suggests that large grocery stores have greater availability of healthy foods at lower costs (Drewnowski et al., 2013; Glanz, Sallis, Saelens, & Frank, 2007; Morland, Diez Roux, & Wing, 2006). This study sought to find if the same phenomena of greater availability apply to organic food items in large grocery stores. In addition, this study sought to compare organic food item availability, variability, and price in large grocery stores located in high- and low-income areas.

Chapter 2 is comprised of a literature review covering a variety of health topics including healthy food availability, elevated prevalence of obesity in low-income areas, certified organic foods, and health risks of pesticide exposure. It also includes an overview of the methodologies from previous studies investigating these topics.

Chapter 2: Literature Review

Introduction

The purpose of this study was to compare the variability and price of organic and conventional food items from the WIC food list in grocery store chains located in both high- and low-income communities. Cost and variability of organic food is a topic of increased public health interest because of the growing body of evidence that organic food decreases exposure to pesticides and related health issues. There is additional interest in how organic food costs and variability impact government funded programs such as WIC which has the discretion to determine if organic food items are included in the approved food item list. During the 2013 fiscal year, WIC supported an average 8.6 million women, infants, and children per month (USDA, 2014a). The state of California has the largest portion of WIC participants in the United States at 17.06% (Johnson et al., 2013). The American Academy of Pediatrics (AAP) and the American College of Obstetricians and Gynecologists (ACOG) recommend consuming a diet of organic foods as a means to decrease exposure to pesticides (AAP, 2012; ACOG, 2013). Unfortunately, not all individuals have the same ability to purchase organic foods. For example, recipients of WIC have restrictions on which organic food items are approved under the program (CDPH, 2011). WIC does approve the purchase or organic produce; however, each family is given a set dollar amount to spend. WIC recipients who would like to purchase organic food items, which are not approved, have to pay for them out of pocket. When it comes to the purchase of produce, WIC recipients are limited in the amount they can spend, and may have to choose between lower priced conventional options or paying the difference of the added cost of organic out of pocket (CDPH, 2011). Ideally, WIC will move towards approving more organic food items and increase the allotment approved for produce to promote organic produce consumption. Another possible solution would be to increase the affordability and variability of organic food items (Horning & Fulkerson, 2014) so consumers have greater access in areas of lower socioeconomics where the majority of WIC recipients reside (Andreyeva, Blumenthal, Schwartz, Long, & Brownnell, 2008; Andreyeva, Long, & Brownell, 2010; Johnson et al., 2012; USDA, 2014c).

At this time, no study has shown if organic food items are offered in the same variety and price points at large chain grocery food sellers across socioeconomic regions. That is, even though the prices can vary *across* grocery store chains, no known study has looked for differences *within* grocery store chains regarding organic food item variability or pricing in both high and low socioeconomic areas. My use of Los Angeles County as a study location provided a unique opportunity to explore access to organic food items, and to the service of WIC in a locale that is not only the leading agricultural producer in the United States, but also has a largest WIC participation in the country. Hence, this research contributes to the gap in understanding by exploring if a difference exists in both food item pricing and variability of WIC food list organic items in large grocery store chains that service both high and low-income neighborhoods.

This study is needed to identify if a difference exists in both food item pricing and variability of a predefined WIC food basket, with conventional and organic options, used in grocery chains stores that service both high- and low-income socioeconomic areas.

This chapter provides a comprehensive review of the body of literature on the following topics: research methods and theoretical frameworks; risk factors, demographics, and rates of obesity in the United States; status of organic foods in the literature; consumer perceptions of and demand for organic foods; consumer demographic barriers to accessibility, availability, and purchasing of nutritious food items; definition of organic foods; and WIC program eligibility and population served. This chapter concludes with an explanation and justification of how the research literature supports my study.

Literature Search Strategy

I conducted a comprehensive literature using databases, including Science Direct, MEDLINE, PubMed, ProQuest Dissertations and Theses, and Google Scholar. Keywords used in my database searches included: *obesity demographics, United States, WIC (Women, Infants and Children) demographics,* C*alifornia WIC (Women, Infants and Children) demographics*, *WIC approved food list*, *California WIC approved food list*, *WIC authorized food retailers, WIC approved vendors, food costs, food socioeconomics*, *organic food, organic food consumers, organic food healthy*, *organic food pesticides*, *organic food retailers*, *organic food prices*, *organic food access*, and *organic food availability.* After I identified initial articles, I reviewed the citations and reference lists to identify related articles. I used primary articles dated prior to 2010 to provide historical context to the topic, but the majority of the articles I reviewed were published after 2010.

Theoretical Framework

The increasing prevalence of obesity has not been adequately explained by individual-level behavior or by the social factors of diet and physical activity. The current body of literature has attempted to explain the complex nature of obesity by focusing on individual risk factors. This strategy, however, ignores the social and physical environment that influences an individual's access to affordable healthy food options within his or her community (Glanz et al., 2005). A more macroscopic view of obesity suggests there are numerous factors that influence and direct healthy food choices including social factors such as behavior, socioeconomics, physicality, allocations of individuals within society (El-Sayed, Scarborough, Seemann,& Galea, 2012). Choices associated with food consumption are examples of behaviors that are strongly influenced by, and at times result from, additional social factors. A broader example of this is the amount of money an individual has, and the cost and availability of desired items not only for individual food choices, but also for needs on a daily, more global, basis.

These factors weave together to direct and influence food choice behaviors that, over time, can become risk factors for disease. In this regard, social factors can become fundamental determinants of health and be used as part of a conceptual framework to identify potential risk factors for disease (El-Sayed et al., 2012; Glanz et al., 2005). The SPDPEH provides a conceptual model to explore how economic and political determinants of health and disease create obstacles inhibiting individuals from living healthy lives (Krieger, 2001). Using SPDPEH provides a theoretical framework to explore the complex nature of how social factors may increase risk for poor health outcomes such as obesity and diabetes.

The environmental justice component of SPDPEH focuses on the inequitable distribution of healthy foods. The disparity in variability and affordability of healthy and affordable foods creates an environmental burden for those without equitable opportunities. My study observed the variability of economically affordable nutritional foods in different socioeconomic areas and investigated if a structural barrier exists.

I used the model of community nutrition environments as a tool to provide measurable components of the nutrition environment. The model of community environment includes four environmental variables: community, organizational, consumer, and information (Glanz et al., 2005). Each of these four environmental variables also aligns with the social factors of SPDPEF. The community nutritional environment includes the type and location of food retailers along with accessibility for consumers. The organizational nutritional environment includes what foods are available at school, work, home, or any location where food can be obtained. The availability of food in each of these various environments may be influenced by availability in other nutritional environments. The home environment may be the most complex and dynamic because it is the most affected by food availability from retailers. Other factors to note may include shopping frequency and food preferences of the primary food shopper. The information environment entails the use of media and advertising of food items. The consumer nutritional environment includes the availability, variability, of healthy food items, cost, and nutritional information. In this study, I explored the consumer nutritional environment section of the model (Glanz et al., 2005). Specifically, I focused on organic and conventional food item variability and pricing of the WIC basket.

The community nutrition environment model was used as the framework in the development of the NEMS-S measures which has been used in a variety of studies including those focused on the WIC participant population (Andreyeva et al., 2012; Franco et al., 2008; Krukowski et al., 2010). The community nutrition environment model provided the framework and support to the research questions I explored in this study. It served as a validated tool to access the variability and price of organic and conventional food items approved under the WIC food list.

The studies that have used the NEMS-S tool have also adopted the community nutritional environment model, providing support for my use of SPDPEF as the theoretical framework for my study without compromising the validity or reliability of the NEMS-S tool. Franco et al. (2008) focused on the sociodemographic aspects of the model under the individual umbrella, without using it directly, to investigate associations between race and income in differing neighborhoods. Krukowski et al. (2010) used components of the environmental factors of the model by examining the demographic factors of a store's neighborhood and size, focusing on healthy food purchasing. Andreyeva et al. (2012) also explored healthy foods and prices as a function of income and neighborhood location. These studies had similar findings suggesting prices, availability, and variability of healthy food items differed based on the location and food retailer. After calculating comparisons of absolute food prices across income areas, Andreyeva et al. (2012) found that prices were on average approximately 4% higher in high-income socioeconomic neighborhoods. Therefore, the use of NEMS-S as an instrument, alone, is supported and documented in the literature. Furthermore, the use of NEMS-S has been used in a variety of studies to examine food prices and variability in both high- and low-income socioeconomic areas. The incorporation of SPDPEF as the theoretical framework in my study aligns with the use of NEM-S and provides a methodology and instrument to explore pricing and variability between organic and conventional food items in low- and high-income socioeconomic areas.

Healthy Diet and Obesity

The Federal Dietary Guidelines for Americans outlines what foods and quantities are needed to be deemed part of a daily healthy diet (USDA; 2010). The 2010 Dietary Guidelines were the result of a culmination of research literature that indicated the typical American diet was energy dense but nutrient poor (Andrieu, Darmon, & Drewowski, 2005; Drewnowski, 2004; Poppitt & Prentice, 1996). In 2010, the average American was described as consuming a daily diet comprised of an excessive amount of calories, refined grains, added sugar, solid fat, sodium (Drewnowski, 2010), and being deficient in vital vitamins and minerals. Overtime, consuming energy dense nutrient poor foods with more calories than are used by the body leads to continued weight gain and increases the risk of chronic malnutrition (Monsivais et al., 2011). The Federal Dietary guidelines called for a daily diet of vegetables, fruits, whole grains, low-fat dairy, and low-fat protein. The quantity of each item was given based on gender, age, and physical activity level. By eating a healthy diet, individuals are able to consume the necessary nutrients in the ideal quantities to not only promote overall health, but also decrease the risk of chronic diseases that are associated with eating a nutrient poor high energy density diet (USDA, 2010). Related research suggested lower-cost diets tended to be energy dense but nutrient poor, while foods with higher energy density were generally associated with nutrient dense foods (Andrieu, Darmon, & Drewowski, 2006; Poppitt & Prentice, 1996).

During this time, Flegal, Carroll, Kuczmarski and Johnson (1998) published a primary article noting that there were not any significant national trends for gender, ethnicity, or income and the risk of obesity. Subsequent research indicated emerging increased risk for obesity among children from lower socioeconomics and Mexican-American and non-Hispanic black adolescents (Ogden, Flegal, Carroll, and Johnson, 2002). Drewnowski (2004) expanded on previous research and explored the relationship between the observed links between childhood and adult obesity and the food environment. Drewnowski (2004) supported the inverse relationship being identified between low-socioeconomics and poor health outcomes such as obesity and diabetes. Andrieu et al. (2006) united both topics and the result of their epidemiological study suggested that diet cost as the principal intervening variable in food purchases and that the lowest priced foods tended to be both energy dense and nutrient poor. The study also supported the findings of the World Health Organization (WHO) in 2003 findings that high energy density diets were associated with higher rates of obesity, type II diabetes, and other poor health outcomes in addition to supporting the recommendation to reduce reducing dietary energy density as a way to reduce the risk of obesity (WHO, 2003). Subsequent research has focused on obesity as a primary risk factor for chronic diseases in both adults and children (Fryar, Carroll, & Ogden, 2012; Levi, Segal, St Laurent, Lang, & Rayburn, 2014; Ogden, Carroll, Kit, & Flegal, 2014).

State of Obesity

Obesity is defined as an excessive amount of body fat in relation to lean body mass whereas, being overweight is described as increased body weight in relation to height and is associated with increased risk of certain diseases and health problems (CDC, 2014a). For adults, this is determined by calculating the body mass index (BMI), a standard measure expressing the relationship (or ratio) of weight to height. The equation is: BMI = (Weight in pounds/ (Height in inches) x (Height in inches)) x 703. Adults with a BMI of 25 to 29.9 are categorized as overweight, a BMI of 30 or more are considered obese. For children, overweight is defined as a BMI greater than or equal to the 85th percentile and obese greater than or equal to the 95th percentile of children of the same age and sex. The use of BMI is considered the gold standard in indicating obesity but used, in tandem with other factors such as blood pressure, cholesterol, and blood sugar (CDC, 2014a).

According to Ogden et al. (2014), 35% of adults and 17% of 2-to-19 years in the United States are identified as obese. The good news is the U.S. population obesity rates have not significantly increased in the last decade and appear to be stabilizing. The progress in adult obesity rates is mixed while the rates for children have seen decreases in some areas of the country (Levi et al., 2014).

In the last 35 years, the obesity rates for adults have more than doubled. Since 2003, the rate of increase began to slow with no significant overall change from 2003 to

2012 (Fryar et al., 2012; Ogden et al., 2014). The most current published national obesity rates are from the analyses of measured values of weight and height from the 2011-2012 National Health and Nutrition Examination Survey (NHANES). The National Health and Nutrition Examination Survey (NHANES) began in 1959 and was created to collect a range of demographic and health data on the U.S. population and collects approximately 5,000 surveys from across the country to provide a snapshot of the current state of health (CDC, 2014b). The National Health and Nutrition Examination Survey (NHANES) is the gold standard in health population data and is viewed to illustrate a highly reliable sample size of the overall population. The National Health and Nutrition Examination Survey (NHANES) has been used to track obesity rates since inception and has expanded to also look at ethnicity, and related health risk that have been identified as being related to becoming obese (CDC, 2014b). During 2011-2012 National Health and Nutrition Examination Survey (NHANES) survey Ogden et al. (2014) reported, more than two-thirds of adults were either overweight or obese, nearly 35% were obese, and approximately 6% were extremely obese (grade 3 obesity). These rates were not significantly different from the 2009-2010 survey results or previous results since 2003 (Fryar et al., 2012; Ogden et al., 2014).

Obesity trends and related behaviors are also examined through the Behavioral Risk Factor Surveillance System (BRFSS) that conducts annual telephone surveys from U.S. residents over the age of 18 and requests participants self-report both health and personal demographic/ behavioral information (CDC, 2014c). The Behavioral Risk Factor Surveillance System (BRFSS) conducted its first telephone survey in 1984 and currently has 400,000 yearly participants and includes participants from every state (Levi et al., 2014). For some communities, the Behavioral Risk Factor Surveillance System (BRFSS) is the only source of population based health specific behavioral data. The Behavioral Risk Factor Surveillance System (BRFSS) survey results have supported the stabilization of obesity rates at the state level (Levi et al., 2014). In 2005, 49 of 50 states reported an increase rate of obesity; from 2007-2008, 37 states reported an increase; from 2009-2010, 28 states reported an increase; from 2010-2011, 16 states reported an increase; from 2011-2012, one state reported an increase, and from 2012-2013, 6 states (Levi et al., 2014; Wang & Beydoun, 2007). A self-reported bias, has been demonstrated in the literature in regards to reporting of height and weight with estimates that data reported in Behavioral Risk Factor Surveillance System (BRFSS) in relation to National Health and Nutrition Examination Survey (NHANES) with BRFSS underestimating obesity prevalence rates for 10% in 1999 and 6% in 2000 (Wang & Beydoun, 2007). While the prevalence rates reported in BRFSS survey may not be as valid as NHANES (measured data) for obesity rates, the survey also collects valuable data on self-reported factors that have been associated with increased risk of obesity (Wang & Beydoun, 2007).

While there has been an overall stabilization of the incidence of obesity rates, all states have seen the percentage of their population who are obese increase. In 1980, no state had an obesity rate over 15%; in 1991, no state over 20%; in 2000, no state over 25%; in 2005, no state over 30%. From 1980 through 2005, or 25 years, the obesity rate per state has doubled. From 2012-2013, two states had rates greater than 35% and 20 states greater than or equal to 30% (Levi et al., 2014). The use of both NHANES and BRFSS surveys, in tandem, provide a broader picture of obesity in the adult population.

The 2010-2013 survey results are more positive for children with NHANES reporting a statistically significant decrease in obese children ages 2-5 (CDC, 2013a; Ogden et al., 2014) and BRFSS reporting decreases in obesity rates in different sections of the country (CDC, 2013a). Ogden et al. (2014) reported in 2011-2012 NHANES for children aged 2-19, nearly one-third of youth were either overweight or obese, and 17% were obese. Whereas, the prevalence among infants and toddlers from birth to aged 2 years to be greater than the 95^{th} percentile for weight was 8% in the 2011-2012 survey (Levi et al., 2014; Ogden et al., 2014). The decrease in childhood obesity was noted among 2- to 5-year-old children from nearly 14% to slightly over 8%. This decrease is not only statistically significant, but also supported by the BRFSS results. According to the CDC (2013a), during 2008–2011, there were 18 states with statistically significant downward trends in obesity for pre-school children, 22 states experienced no significant change, and three states had statistically significant upward trends.

During the tenure of NHANES and BRFSS, the survey questions and data collection methodology has evolved as the conversation of health and risk factors for disease evolved. For the 2011-2012, survey cycles, BRFSS underwent significant changes in the methodology and broadened the nature of the demographical data being collected (CDC, 2014c). Due to the degree of change from the 2010-2011 to the 2011-2012 survey methodologies, it has been suggested in the literature not to conduct direct comparisons between the data results between those two annual cycles (CDC, 2013a;

CDC, 2014c; Levi et al., 2014). With that said, all subsequent discussions regarding ethnicity and socioeconomics will focus on data reported after the updated BRFSS process in 2011.

The national level data provide an overview of the state of obesity, but there is more to be learned about which demographic groups and geographical locations are more prevalent. The current body of literature suggests and supports both ethnic and socioeconomic disparity in obesity rates across the country for both adults and children. The primary database used for obesity prevalence analysis is NHANES. This database has limitations in its ability to contribute prevalence trends by ethnicity. Many of the sample sizes prior to 1999 were not large enough to conduct such calculations. In an effort to address this limitation, the NHANES data set updated their survey and testing methodology in 1999 and began oversampling subgroups of the population to be more congruent with the ethnic categories present in the overall U.S. population (Ogden et al., 2002). The oversampling of Mexican Americans occurred from 1999 to 200 and 2005-2006, of all Hispanics in 2007, and non- Hispanic Asians in 2011 (Ogden et al., 2014). In addition, in 1999 the survey began to collect data continuously and report every two years. The power of the data analysis is limited in its ability to detect small changes in prevalence, especially among subgroups such as ethnic groups. The survey also excludes pregnant women, removing data from this subgroup from the conversation (Ogden et al., 2002).

Ogden et al. (2002) used the updated 1999 NHANES data, which indicate an increase in obesity rates of Mexican American boys aged 6 through 19 years than non-

Hispanic white and African Americans. Hedley et al. (2004) utilized NHANES 1999-2002 data to report in increased prevalence of being overweight for non-Hispanic African Americans and Mexican American girls. This initial trend was supported in subsequent survey years and it related studies. Anderson and Whitaker (2009) utilized the Early Childhood Longitudinal Study Birth-Cohort (ECL-B) which used a clustered list-frame design to obtain data from the National Center for Health Service from approximately nine months through four years. The ECL-B collected data for children born after 2001 and collected a nationwide sample size. The ECL-B obtained the ethnicity from the birth certificates of the participants and purposely oversampled American Indian/ Native Alaskan, Chinese, and other Asian/ Pacific Islanders to provide large enough sample sizes of these subgroups for analysis. The ECL-B database provided ethnic based data for these subgroups filling a gap in the literature. Anderson and Whitaker (2009) supported the growing body of literature that non-Hispanic African Americans and Hispanics had childhood obesity rates that were significantly higher than non-Hispanic White and Asian Children. Anderson and Whitaker also found the prevalence of obesity of American Indian/ Native Alaskan was nearly twice as high as non-Hispanic White and Asian Children. Scharoun-Lee, Kaufman, Popkin and Gordon-Larsen (2009) added to this conversation by providing additional support on the increased prevalence of obesity in both Hispanic and African American youth by examining data from The National Longitudinal Study of Adolescent Health (Add Health) a nationally representative sample of U.S. students grades 7-12.

In the most current published study, the 2011- 2012 data cycle, Ogden et al. (2014) reported childhood obesity prevalence were lower in non-Hispanic Asian children than other ethnic groups. The results were 15% for non-Hispanic white children, 20% for non-Hispanic black children, and 22% of Hispanic children. Additionally, the prevalence of obesity was also lower among non-Hispanic white youth compared with non-Hispanic black youth and Hispanic youth. For adults, there were also differences between ethnicities with 42 % Hispanic and 48% non-Hispanic Black having higher prevalence than non-Hispanic white at one-third and non-Hispanic Asian at 11% (Ogden et al., 2014). There are increases in obesity rates for children across all ethnic subgroups with some ethnic groups showing increased prevalence of obesity over others. Of those ethnic groups included in nationally representative studies, the obesity rates of Hispanic, African American, and American Indian/Native Alaskan are higher than non-Hispanic White and Asian children. However, non-Hispanic children have significantly higher obesity rates than Asian children.

The research identified similar trends and ethnic subgroup limitations in adults. When the research community began analyzing data on ethnicity, there were often only large enough sample sizes to identify trends for non-Hispanic black, Mexican Americans, and non-Hispanic White. Ogden et al. (2002) published some of the first elevated prevalence, for ethnic subgroups from the NHAES surveys collected in 1999. For women 20 years and older there is an increase prevalence of obesity for African Americans and Mexican Americans. This trend was supported not only in subsequent survey years, but also in other studies during this time (Pan et al., 2009; Wang & Beydoun, 2007). Ogden et al. (2006) utilized the data from 1999-2005 to increase the overall sample size and support previous findings. The inference gleaned from obesity prevalence rates from NHANES was limited as sample sizes were too small to analyze when multiple demographic factors were used. In addition, there were several demographic categories such as socioeconomics, which were not able to be included in the analysis. While the ethic trends were not always considered statistically significant, from data set to data set, it did support other studies findings of higher obesity prevalence for non-Hispanic black and Hispanics than their non-Hispanic White and non-Hispanic Asian counter-parts (Flegal, Carroll, Ogden & Curtin, 2010; Ogden, Carroll, Kit, & Flegal, 2012; Wang & Beydoun, 2007). Pan et al. (2009) examined the Behavioral Risk Factor Surveillance System (BRFSS) surveys from the 2006–2008 cycle and found Non-Hispanic blacks (36%) had 51% greater prevalence of obesity, and Hispanics (29%) had 21% greater prevalence, when compared with non-Hispanic whites (24%) adding to the growing body of literature and supporting increased obesity rates among several ethnic subgroups. The use of the BRFSS survey data also provided the opportunity to look at these rates by state and findings indicate most states supported the nationally represented pattern but did vary in the prevalence rates of obesity in individual ethnic subgroups. It has been more difficult for some less prevalent ethnic subgroups, such as the American Indians, to be adequately represented in national studies. To address this there have been smaller studies conducted to project the obesity rates for American Indian adults. Hodge, Cantrell and Kim (2011) conducted a randomized cross-sectional self-reported survey drawing participants from rural reservations in California. The study suggested that the American

Indian obesity rates were not only higher than the general U.S. adult obesity rates, but also higher than any other ethnic group, aside from African American women.

When looking at the obesity rates for both children and adults, all of the ethnic groups that have elevated obesity rates for children, are also elevated for adults. This finding was one of the many factors identified in the literature and being potentially significant. One of the benefits of using surveys, either self-reported or collected by researchers, is that a variety of demographic data is collected. When analyzing these factors, patterns and trends start to emerge. One of these trends, which continued to emerge, was the socioeconomic status of the participant. The consensus in the literature supports those ethnicities with high obesity rates are also typically of lower socioeconomic status (SES). Interestingly, the relationship is not necessarily inversed between obesity and SES. A few studies have looked at SES and ethnicity as predictors for obesity and found that the association between SES and obesity varies by ethnicity and that the ethnic differences in obesity rates are not completely explained by an individual's SES (Jones-Smith, Dieckmann, Gottlieb, Chow & Fernald, 2014). Some studies have suggested SES and ethnic disparities may arise early in childhood. Many of the nationally based studies, such as NHANES and BRFSS, are limited in their ability to track obesity over time as they are conducted as recurrent cross-sectional studies. Few studies have followed a nationally representative study population over time exploring how SES relates to obesity within ethnic groups. Jones-Smith et al. (2014) used a longitudinal study design to look at participants from birth until age five to six. This study was the first known study to report the trajectory of obesity rates over time (birth to age six) according to SES and within ethnic grouping. This study suggested how SES and obesity may not be a simple inverse relationship and how different the obesity rates of differing ethnic groups responded to SES stressors.

Overall, the literature supports the general statement that those who are obese come from lower socioeconomics than those who are not. However, obesity is seen across socioeconomic levels for both children and adults. With that said, the association between obesity and low SES is very strong across ethnic groups (Hodge et al., 2011; Scharoun-Lee et al., 2009). Among adults, populations with low SES, who are African American, Hispanic, and American Indian experience disproportionate obesity rates, compared to higher SES, non-Hispanic whites, and Asians (Anderson & Whitaker, 2009; Flegal et al., 2010; Jones-Smith et al., 2014). Obesity trends influenced by SES and ethnicity in early childhood are increasing seeing as being predictive of adult obesity rates. For example, American Indian children have an obesity rate twice that of non-Hispanic whites or Asians. This trend continues in adolescence with African American, Hispanic, and American Indian females having obesity rates greater than or equal to twice that of non-Hispanic whites and Asians. In addition, children and adolescents of low SES have higher risks and rates of obesity than those of higher SES (Hodge et al., 2011; Jones-Smith et al., 2014; Ogden et al, 2014).

The concern of health disparities by ethnicity and SES has been a topic that has both received considerable attention in the literature, and also public policy and education. In the last few years, the associated risk of obesity by SES and ethnicity decrease in some studies, and increase or remained unchanged in others (CDC, 2013b;

Rossen & Schoendorf, 2012; Singh, Siahpush & Kogan, 2010). The possible decrease in obesity trends in pre-schooled children has been the most promising (CDC, 2013a; Levi et al., 2014).

Overview of Obesity Research

These efforts included providing research mediated dietary recommendations, preventative programs, policies, and regulations to improve education and access to healthy food items. While current programs have been generally ineffective at reducing overall obesity rates, they have been able to contain the epidemic and obesity rates have stabilized. This success, while minor, does provide the opportunity to evaluate and analyze current efforts and identify how best to move forward. Currently, obesity research and treatment recommendations are undergoing a shift in paradigm. The antiquated canned advice to eat less and exercise more has proved to be too simplistic and ineffective. Even the more modern current recommendation to eat more nutritious food and exercise has proven to be ineffective. Obesity is not only a disease of an individual, but also a disease epidemic of a nation. The modern paradigm is looking at obesity from the individual to the population level with the knowledge that the issue is not simplistic, but exceedingly complex. To address obesity effectively not only do individuals need to reach healthy bodyweight, but maintain that weight life-long (Gortmaker et al., 2011). First, a discussion on the background on the fundamental understanding of obesity, evolution, and lessons learned.

The long-standing belief was that obesity was a disease of the individual and what was needed was to identify who became obese and understand why and with that knowledge, preventative programs and treatments could be created and provided to obese individuals to reduce their body mass to a healthy weight. To tackle this issue, an extensive search was employed reviewing the research, education, policy, and regulations efforts deployed to tackling this issue.

The current body of literature suggests the root of obesity is the everyday eating habits and food choices of the individual. While the underlying behavioral patterns and their environmental determinants may be complex, the chronic energy imbalance and physical activity habits drive weight gain and obesity. According the literature, the average American consumes an excessive amount of refined grains, added sugar, solid fat, and sodium (Drewnowski, 2010) leading to diet deficient in vital vitamins and minerals with an excess of calories. The net consequence is a caloric imbalance with individuals storing the excess calories as fat. Overtime, consuming more calories than are used by the body leads to continue weight gain (Monsivais et al., 2011).

Organic Impact on the Market

Organic Food Definition

Organic food items are the result of farming and raising livestock that avoids the use of synthetic chemicals, antibiotics, hormones, irradiation, and genetic engineering (United States Department of Agriculture (USDA, 2014b). To ensure food items are labeled as organic, the National Organic Program (NOP) of 2002 creates standards for organic food production and only food that adhere to those standards qualify to be labeled as organic. In order to qualify, crops cannot be genetically engineered or exposed to ionizing radiation. Additionally, crops must be grown on farms that have not used unapproved synthetic chemicals (such as herbicides and pesticides) for three years and provide an adequate buffer from other farms that may use unapproved products. The fertility of the soul is maintained primarily through cultivation practices and rotation of crops. The approach to unwanted weeds or pests is use physical, mechanical, and biological controls. The standards for livestock are similar, and raised without the routine use of antibiotics or growth hormones, and must have access to the outdoors. In the event an animal needs to be treated with antibiotics, it can no longer be sold as organic. Instead, preventative health practices are employed such as vaccinations, and vitamin supplements are used to promote livestock health (USDA, 2014b).

A farmer who wishes to be certified as organic must also apply for certification, pass a test, and pay a fee in addition to adhering to all of the standards listed above (USDA, 2014b). Once a farmer is certified, the NOP also requires annual inspections of the farm to ensure compliance with all required standards. The inspections not only included the current livestock/crops being raised and conditions, but also records that the standards have been met since the last inspection. The NOP's ongoing involvement in certification and inspection provides an industry standard for farmers and peace of mind for organic consumers (USDA, 2014b).

Organic Foods and Health

In terms of health advantages, diets with organic foods expose consumers to lower levels of pesticides and antibiotic-resistant bacteria than conventional (non-organic) foods that have been associated with disease. The case for organic foods began to gain momentum when the National Research Council (NRC) issued a report in 1993 concerning organic food products (Forman et al., 2012). According to Forman et al. (2012), the NRC report cited scientific research that organic produce consistently demonstrated lower levels of pesticides than conventionally grown. Additionally, pesticide exposures in children primarily occur through consumption of affected food and, therefore, a diet of organic produce reduces human pesticide exposure. The 1993 NCR report was limited to the study of organic versus conventionally grown produce, but it consolidated the primary themes identified in the literature and assisted in establishing the need for additional research.

In the time since the 1993 NCR report, the research community has explored the possible health benefits of organic food items. It is the possibility of a positive impact on health, especially vulnerable neonatal and pediatrics populations, together with increasing customer demand, that spurred additional research and interest of the potential benefits of an organic diet. Presently, the research community is still unconvinced to what extent an organic diet may be superior to a conventional diet. However, the literature supports that eating an organic diet does reduce exposure to pesticides and antibiotic-resistant bacteria. The primary barriers include a lack of standardized methodology of how to categorize, assess, measure, or quantify health benefits. The high number of heterogeneous studies, some of which are limited in number, has contributed to a lack of strong evidence that organic foods are statistically significantly more nutritious than conventional foods. Additionally, how significant the reduction of exposure to pesticide residues and antibiotic-resistant bacteria may be.

Pesticide Exposure from Food

Food items can be contaminated by pesticides, especially insecticides, because of the farming process during the growing, cultivating, and storage processes. Therefore, the majority of the population regularly consumes foods with pesticide residues. While it is important to note pesticide exposure is not limited to food consumption, it can be a daily source. One of the primary reasons why pesticide residues found in foods is a concern is because prolonged pesticide exposure increases the risk of cognitive, reproductive, endocrine, immune, respiratory system impairment and cancer in children (ACOG, 2013; Liu & Schelar, 2012; Shelton et al., 2014).

There are several categories of chemical pesticides in use with the most common being organophosphates. Organophosphates (OP) are one of the most frequently used categories of chemical pesticides and currently the most commonly used in food crops. Despite their frequent use as an insecticide, they metabolize quickly and do not persist in the environment. The OPs mode of action is to target the nervous system and irreversibly inactivate the enzyme, acetylcholinesterase that regulates a specific neurotransmitter acetylcholine. The result is both a cease of function for both the peripheral and central nervous systems resulting in rapid death. However OPs are not just lethal to insects, at high concentrations they are also lethal to humans. Despite the potential toxicity to humans, OPs are used, as they do not persist in the environment and pose less environmental and health risks than alternative pesticides such as organochlorines. For the last thirty years, OPs have been the most commonly used insecticides in the United States. The potential health risks of OPs are a topic of on-going research with the EPA banning residential use in 2001 (Bouchard, Bellinger, Wright, & Weisskopf, 2010). United States Environmental Protection Agency (2006) conducted chemical -specific risk reassessments for all pesticides including OPs that resulted in substantial reductions in agricultural uses. Despite these reductions, over 33 million pounds of OPs were used in 2007 (Curl et al., 2015) and OPs are still used agriculturally in the raising of food crops such as grain, fruits, and vegetables.

OP is a synthetic compound and intrinsically chemical nature and when they enter the body, by ingestion for example, they can undergo a number of biotransformations with the tissues and compounds they come in contact. They are inherently unstable and consequently are not routinely stored in human tissue. Therefore, the risk and subsequent negative health consequence of isolated exposures is low. However, when looking at the risk of OP exposure from foods, the exposure can be variable, depending on fluctuations in diet choices. The risk of long-term exposure is that OPs are lipophilic and can be stored in adipose tissue while being absorbed and released from the adipose cells depending on diet and weight fluctuations of the individual. The result is a potential for prolonged and variable exposure to OPs. There are two routes of oral exposure: (1) direct ingestion of food items with OP residue and (2) direct contact with contaminated objects with the mouth (Kavvalakis & Tsatsakis, 2012).

As OP is metabolized in the body, one of the byproducts is dialkylphosphate (DPA) which is then secreted in the urine. There are a few ways to test for OP exposure either in the blood or in the urine. Traditionally, exposure to OPs is determined through a blood test measuring the reduction of acetyl Cholinesterase enzyme (AchE) activity. A limitation in this testing methodology is it lacks selectivity and sensitivity for low-level exposure and requires a base-line level in non-exposed individuals before the exposure. Therefore, testing for AchE in the blood is better suited for high-level isolated exposure to OP. For a regular, potentially daily, low level exposure to OP testing for DAP in the urine is the preferred method. Studies who have explored OP exposure tend to use urine to confirm OP exposure in the general population, known exposed individuals, pregnant women, and children.

According to a literature review by Kavvalakis and Tsatsakis (2012), the percentage of detectible positive urine specimens for DAP ranged from 0% to 100%, with the average being 66% of the studies reviewed from 1985-2006. Barr et al. (2011) conducted a cohort study utilizing data from the National Health and Nutrition Examination Survey (NHANES) from 1999 -2004. In the study, it was noted that OP exposure was prevalent within the study population with metabolites of OPs, called DAP, were detected in the urine of 77% of the study participants from the 2003-2004 survey. With the National Health and Nutrition Examination Survey (NHANES) survey participants being representative of the overall U.S. population, it is possible that more than 75% of the US population has detectible levels of OP in their urine.

The long-term clinical significance of non-occupational exposure in adults is not well understood. There has been special focus on pregnant women, infants, and children in the literature as these populations are especially vulnerable. The literature supports that the negative health consequences are more significant for neonates, infants, and children as even low levels of pesticide explore can affect this population’s neurological and behavioral development (Forman et al., 2012; Liu & Schelar, 2012). According to Kavvalakis and Tsatsakis (2012), several studies have indicated OPs are mutagenic, carcinogenic, cytotoxic, genotoxic, teratogenic, and immunotoxic. The evidence shows a link between pesticides and reflexes, psychomotor abilities, and cognitive development (Liu & Schelar, 2012).The research suggests a link between pesticide exposure and attention- deficit disorder (Bouchard et al., 2010). The risk and potential health consequences of pesticide exposure vary based on location, severity, and frequency of exposure. To explore these possible correlations, researchers have looked at specific subsets of the population focusing on modes of exposure and subsets of this population.

Pregnant Women and Neonates

The body of literature provides robust evidence that prenatal exposure to certain pesticides, such as organophosphates, increases the risk of cancer in childhood (ACOG, 2013) and abnormal and impaired neurodevelopment in children (Bouchard et al., 2010, 2011; Engel et al., 2007; Shelton et al., 2014). Developing fetuses and infants are of higher susceptibility to pesticide exposure due to the ready transmission of some pesticides through the placenta and the underdeveloped metabolic system to process and excrete these chemicals (Furlong et al., 2014). Specifically, prenatal exposure to pesticides can induce developmental neurotoxicity, and has been associated with developmental delay and autism. According to Engel et al. (2007), the risks of pesticides in neonates were primarily studied by Young et al. in pregnant women who worked in agricultural areas. The primary studies exploring negative health outcomes through prenatal pesticide exposure looked at DAP levels, metabolite of OPs, in the urine periodically during gestation. While the exposure levels for a population of pregnant women would be greater, the results of these studies identified the possibility of an association and provided justification to broaden research studies to other populations of pregnant women. The preliminary studies were heterogeneous in design and methodology with generally small sample sizes. This made it difficult to generalize the study results to other studies or to similar populations. A literature review by Kavvalakis and Tsatsakis (2012), indicated that for pregnant women DAP levels are detectable in urine samples ranging from 0% to 99% of the studies samples with the average percentages for all DAP samples tested were nearly 60%. The wide variance of DAP urine levels was supported by a national representative sample, from the NHANES survey 1999-2000, with more than 25% of pregnant women with DAP levels exceeding the median levels measured in the general population (Bouchard et al., 2011). Additional studies looked at the DAP levels in amniotic fluid and meconium, that provided a more complete picture of OP exposure over the course of a pregnancy.

In a primary study by Tsatsakis, Tzatzarakis, Koutroulakis, Toutoudaki & Sifakis (2009) six DAP metabolites were found in over 60% (37%-92%) of the samples. The clinical significance of this is unknown however; there is growing evidence that OP exposure in pregnant women also exposes fetuses during gestation. The studies that have explored DAP metabolites in meconium samples are limited and a gold-standard for testing has yet to be established which will be needed to allow results from individual studies to be better compared and to allow for a quantitative meta-analysis before any conclusions can be made (González-Alzaga et al., 2014).

Studies in Children

Pesticide exposure in children, and possible clinical indications, has been highly debated in the literature. Children are uniquely vulnerable to pesticide exposure and the potential negative health consequences of prolonged, even low dose, exposures. There is also a growing body of evidence indicating that pesticide exposure and risk of negative health consequences can begin while in the womb. The primary exposure routes for children to pesticides occur through ingestion, inhalation, or skin contact. Accidental ingestion through contact with contaminated objects, such as hand-to-mouth contact coupled with children's higher intake of foods and fluids per pound of body weight, places children at both higher risk of exposure and dose compared to adults (Roberts et al., 2012). According to Maffis (2014), the added risk of ingested exposure for children can be seen by the amount of food a six month old child would consume, 110g food/kg/day, compared with that of an a child through adolescence, 30 g/kg/day to age 15 years. The amount of food consumed per body size continues to decrease until adulthood. The result of this the increase of food per body weight in young children through adolescence increases the risk of and amount of possible pesticide exposure through ingestion.

The risk of negative health consequences in small children from pesticide exposure is compounded by children's immature livers and excretory systems, that may not as able to effectively remove pesticide metabolites from the body (Liu & Schelar, 2012). These metabolites, such as DAPs, may block the absorption of critical nutrients in children's diets, which may further place this vulnerable population at risk (Chalupka &

Chalupka, 2010). The primary basis of this elevated risk is that children are more susceptible to pesticide toxicity, neurotoxins, because the brain is still developing. Children are exposed to higher dose of pesticide per body weight, engage in lower levels of physical activity, and have fewer enzymes that detoxify activated forms of some OPs than adults (Bouchard et al., 2011). The negative health consequences of OP exposure have been associated in a wide range of impaired neurodevelopment and lower IQ in children (Bouchard et al., 2011; Engel et al., 2011; Furlong et al, 2014; Shelton et al., 2014). Other studies have linked pesticide exposure with negative health outcomes in a variety of body systems including the reproductive, endocrine, immune, and respiratory (Liu & Schelar, 2012).

While negative health consequences in children have been associated with pesticide exposure within a variety of body systems, the severity and specificity of health effects of chronic pesticide exposure in children vary. Cohort and cross-sectional study methodologies have been used for the association between pesticide exposure and negative health outcomes. The initial studies suggested that chronic pesticide exposure and measurable OP metabolite concentrations may have negative health consequences using case-control or cross-sectional studies. A number of factors, including inability to measure past OP exposure, and to explore a possible relationship between OP exposure and negative health outcome, limited these studies. The use of cohort studies have assisted researchers understand the incidence of negative health outcomes in different populations of people while also providing insight into possible causation.

At this time, three independent birth cohort studies in the United States found an association between prenatal OP exposure and lower IQ in children (Bouchard et al., 2011; Engel et al., 2011; Eskenazietal, 2007). Interestingly, all three found that exposure varied among the populations. Additional cohort studies have cited associations between prenatal OP exposure and neurological impairment in infants, toddlers, and preschoolers (Bouchard et al., 2011; Marks et al., 2010; Rauh, et al., 2011). Various cohort studies have found an association between OP exposure and behaviors associated with attention-deficit hyperactivity disorder (ADHD) with study participants at three (Rauh, et al., 2011) and five years of age and seven through twelve years (Bouchard et al., 2010; Furlong et al, 2014) but not at two years (Marks et al., 2010). Marks et al. (2010) added that the ability to measure the attention of two year olds accurately might be limited as this age group may be too young to manifest detectible attention symptoms. Additionally, while ADHD is occasionally diagnosed in children as young as two, the symptoms are more readily detected once a child begins school. Studies in older children have found associations in OP exposure and neurobehavioral deficits (and changes in the brain morphology (Rauh, et al., 2011).

Unfortunately, at this time, there are few cohort studies of prenatal exposure of OP pesticides and neurological impairments, such as ADHD, in childhood. The research literature is in large part is composed of a limited number of relatively small cohorts that have been followed over a period of years. The Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS), rural agricultural area in California (Bouchard et al., 2011; Eskenazi et al. 2014; Marks et al., 2010; Raanan et al, 2014), and two urban communities in New York City, the Mount Sinai Children's Environmental Health Cohort study (Engel et al., 2011; Furlong et al., 2014) and the longitudinal birth cohort study of inner-city mothers and children (Columbia Center for Children's Environmental Health) **(**Rauh, et al., 2011; Rauh, et al., 2012) have been used as primary cohorts in these studies**.** All of these cohort studies have followed pregnant mothers with children born from 1998- 2001 and are being followed prospectively. The cohort sizes range from 404 to 601 at time of study and as of the latest publications for these children, ages from 7-9 the remaining cohort ranges from 173 to 329 participants. Interestingly, while the nature and extent of OP exposures in this population are likely to vary substantially, each cohort has found an association between OP exposure and neurological impairments. It is important to note that while each of these cohort studies began as prenatal exposures, it is possible that there is a potential of postnatal OP exposure as well. Despite this, there have been some troubling patterns developing in these prospective cohort studies.

Of the primary study cohorts, CHAMACOS was the first to associate OP exposure with negative neurological consequences. The focus of this cohort population has been ADHD with Bourchard et al. (2010) identified 119 children meeting diagnostic criteria for any ADHD subtype. This corresponds with a population prevalence of 12% for any ADHD subtype and nearly 8% for inattentive subtype, nearly two percent for hyperactive/impulsive subtype, and three percent for combined subtype (Bouchard et al., 2010).

Subsequent research, at the national level supported Bourchard et al. findings of an increased prevalence of ADHD at 3.5 and 5 years (Forman et al., 2012) and ages 8 through 15 (Bouchard et al., 2010). Additional research has associated OP exposure in children and impaired cognitive functioning as early 12 months (Engel et al., 2011) and a lower mental development index scores at 2 years of age (Bouchard et al., 2010). Each of these studies found children with higher OP metabolites in their urine were more likely to be diagnosed with neurological impairment than children with undetectable levels. Specifically, these risks include ADHD a 10-fold increase in OP metabolites was associated with an odds ratio of 1.93 (Forman et al., 2012) odd ratio 5.1 (Marks et al., 2010) compared with children without detectible OP urine metabolite levels. The odd ratio did vary, in part, due to the small sample size of the cohorts studied which can be seen in the confidence interval.

Interestingly, OP has a variety of metabolites and various studies focused on different metabolites that have made more than general comparisons between studies more difficult. Curl et al. (2014) cites the United States Environmental Protection Agency report where OP toxicity can vary as much as 6,000 fold, the lack of specificity limits the effectiveness of DAP values when looking at risk or odds of negative health consequences. Of the reviewed literature, dialkyl phosphate (DAP), a broad category comprised of six specific metabolites that collectively, include approximately 80% of total OP pesticides were used (Bouchard et al., 2010; Bouchard et al., 2011; Curl et al., 2014; Furlong et al., 2014). Additional studies used diethyl (DE) and dimethyl (DM) each includes three of the main six metabolites (Marks et al., 2010; Bouchard et al., 2011). All but one of the studies tested the DAP levels in urine with one study looking at DAP levels in umbilical cord blood samples (Raul et al., 2011). The lack of gold standard on how to measure OP exposure is due, in part, to the limiting nature of urine metabolite testing. Ideally, a mechanism that is able to quantify exposure to known toxicity levels of the parent OP compound. A gold standard would allow researchers to measure typical routine chronic exposure to OP, as reported in studies exploring pre and post-natal exposures. The DAP urine testing was created and intended for acute exposures in occupational settings. This secondary measurement tool sought to provide insight in how OP exposure places an individual at higher risk for neurological impairment and other negative health consequences.

More recent studies have begun looking at Paraoxonase (PON1) (Engel et al., 2011; Eskenazi et al. 2014), a genotype that is related to the enzyme activity of arylesterase in the primary prospective cohorts. PON1 is related to the ability to breakdown OP metabolites, and is believed to be a susceptibility factor for the possible negative health effects of Op exposure. Additionally while there has been limited research in utero studies in humans, animal models (rats) have demonstrated early exposure to OPs resulted in neurological impairment (Shelton et al., 2014). Subsequent animal testing may be able to provide more insight into how OP exposure places children at higher risk for negative health consequences. In addition, subsequent studies need to clarify the underlying mechanisms between OP exposures and increased risk for ADHD as well as utilizing study designs that include genetic information as both ADHD and susceptibility to OP may have a genetic component.

Despite limitations, evidence that testing pre-natal and post-natal chronic exposure to OP pesticides will indicate most pesticide exposure occurs through diet. . With neonates and young children found to have the highest levels of urine DAP levels (Roberts et al., 2012). While OP exposure from diet provided relatively low levels of exposure, it is chronic. The research has demonstrated that even low doses of OP exposure can inhibit the body's ability to break down OP metabolites prohibiting the acetylcholinesterase function and can influence the functioning of neurochemical targets, growth factors, neurotransmitter systems, and second messenger systems (Bouchard et al., 2011).

Recommendations

The potential association between pesticide exposure and negative health consequences in susceptible populations was recognized with the 1993 report from the National Research Council assessment that children will require an individualized approach to determining their risk due to their unique vulnerabilities to these environmental toxins (Liu & Schelar, 2012). Further, the risk assessment will need to include an approach that addresses the on-going organ development and critical periods of neurological development. Lastly, adverse pesticide exposures can cause permanent damage to children especially exposures that occur in utero (Chalupka & Chalupka, 2010). The subsequent research addressed many of these areas and demonstrated that children with high levels of OP exposure were at higher risk for negative health consequences. In 2012, because of information gleaned from prospective cohorts tracking specific populations of children and supporting research from national studies, the

American Academy of Pediatrics issued guidelines for Pediatricians (APA) regarding pesticide exposure in children and the threat to health. While the 2012 APA recommendations were general, they did provide a subsequent path for research on this topic and guidance on this emerging threat. The APA recommendations to Pediatricians were that efforts should be made to limit children's exposure to pesticides as much as possible (Roberts et al., 2012). Similar recommendations were provided by the American College of Obstetrics and Gynecology (ACOG) to counsel prenatal and preconception patients to decrease their exposure to pesticides that can help decrease the risk of negative health consequences for their unborn children (Sathyanarayana et al., 2012). The consensus in the literature is that for the general population, the food supply represents the most important source of exposure for pesticide exposure (Roberts et al., 2012). Both the APA and the ACOG suggest considering the purchasing and consumption of organic produce when possible with the ACOG suggesting focusing on the "Dirty Dozen" a list of the twelve products with the highest risk of pesticide exposure provided by Environmental Working Group (EWG; 2015).

Organic Versus Conventional Foods

There was a growing interest in the research community of the overall safety of conventional food items and if organic food items were safer. There have been quite a number of meta-studies or literature reviews revising the state of research of the difference between organic and conventional food items to help provide scientific based recommendations and guidelines for consumers (Brandt, Leifert, Sanderson, & Seal, 2011; Forman et al., 2012; Huber et al., 2011; Palupi et al., 2012; Smith-Spangler et al., 2012). To address this gap, a variety of food categories were explored to determine if there was a health benefit found between organic and conventional items. The foods explored included produce (Brandt et al., 2011), dairy (Palupi et al., 2012), or a combination of produce and dairy (Forman et al., 2012), or produce and meat (Huber et al., 2011; Smith, 2015; Smith-Spangler et al., 2012). The overall safety of each food category varies based on the food. The primary concern for dairy and meat, primarily bovine, added growth hormones and increased exposure to antibiotics that are routinely used in conventional livestock systems. Concerns for produce, fruits and vegetables, included presence of pesticide residues that are a standard aspect of crop cultivation in conventional food items.

Dairy and Meat

A primary safety concern of conventional bovine meat and milk include added growth hormones (GH) that are results of traditional husbandry practices. According to Forman et al. (2012), GH supplementation of cows increases milk yield by 10%-15%. The concern was that bovine GH may have negative health consequences, as it is a hormone secreted in bovine milk. Several studies have demonstrated that GH is species-specific and biologically active only in bovines and therefore does not have a physiologic effect on humans (Forman et al., 2012; Schwendel et al., 2015).

The focus on possible health benefits of organic milk has been the acid composition as it is most readily influenced by changes in bovine diet. The literature has been largely equivocal on differences between organic and conventional milk. Controlled studies evaluating possible differences between organic and conventionally produced bovine milk have so far been largely equivocal due primarily to the complexity of factors that can influence milk composition and an understanding of which factors are most significant to human health. Some of the primary factors that affect the composition of milk between organic and conventional husbandry systems include the country, region, year, and season when milk is produced. Other factors can include the breed, stage of lactation, and diets between individual cows. Studies that did not include or consider these factors when exploring possible differences in conventional and organic systems, could have biased results. To address limitations in individual studies, meta-analysis models employed to glean insight on the significance some of these factors may have on milk production. The most recent meta-analysis included both broad husbandry practices and variations of the cows involved in both organic and conventional farming practices. Schwendel et al. (2015) found no significant differences between organic and convention milk composition that supports previous findings (Forman et al., 2012; Palupi et al., 2012).

Another concern is the presence of antibiotic resistant bacteria in the meat supply that could place consumers at elevated risk and exposure to antibiotic resistant bacteria. Animal husbandry uses antimicrobials extensively in food animal production, where they are administered subtherapeutically to promote grow and to prevent and treat disease. Research evidence has supported administration of nontherapeutic doses, of some antibiotics, can increase the size of the animal which increases meat yields. As a result, conventional animal husbandry frequently includes the administration of nontherapeutic doses of antibiotics for this purpose. To demonstrate the scope of this practice it is estimated between 40% and 80% of all of the antimicrobial agents used in the United States each year are used in animal husbandry with 75% of all antibiotics administered to animals given in subtherapeutic doses (Forman et al., 2012). The risk to humans is nontheraputic use of antibiotics, promotes the development of antimicrobial resistant bacteria in the animals subsequently used for food. The subtherapeutic dosing of antibiotics is added to the livestock's feed and is therefore incorporated in the animal's daily diet. In addition, to nontherapeutic dosing for growth, therapeutic doses of antibiotics are given to treat bacterial infections animal may incur. Antimicrobial agents given to livestock for growth or therapeutic treatment are identical or similar to those used in humans (Federal Drug Administration [FDA], 2013). Research evidence has supported that these antibiotic resistant bacteria have traveled through the food chain (FDA, 2013; Forman et al, 2012; Pesavento et al., 2010; Waters et al., 201).

Conversely, organical husbandry avoids the use of synthetic chemicals, antibiotics, hormones, irradiation, and genetic engineering (United States Department of Agriculture (USDA, 2014b). Additionally, the standard is to raise livestock without the routine use of antibiotics or growth hormones. In the event an animal needs to be treated with antibiotics, it can no longer be sold as organic. Instead, preventative health practices are employed such as vaccinations, and vitamin supplement are used to promote livestock health (USDA, 2014b). The underlying intent of organically raised meat is the reduction/ elimination of exposure to antibiotic resistant meat.

The Federal Drug Administration (2013) survey is conducted yearly by the National Antimicrobial Resistance Monitoring System (NARMS) monitoring retail meat and poultry for enteric drug resistant bacteria that can cause human disease Campylobacter species, Salmonella species, and Escherichia coli. Additional studies have looked at *Staphylococcus aureus* (Casey, Cuirriero, Cosgrove, Nachman, & Schwartz, 2013; O'Brien et al., 2012; Smith, 2015; Waters et al., 2011). The amount of antibiotic resistant bacteria found in various retail meats was mixed. This may be, in part, because the survey does not currently differentiate testing in conventionally and organically raised livestock. Despite this gap in the NARMS, additional studies have been conducted evaluating the bacterial load of bacteria between conventionally and organically livestock practices.

Campylobacter, Salmonella species, and Escherichia coli can cause disease in humans and typically is acquired through the consumption of contaminated foods; mainly meat (FDA, 2013). The animals where these bacterial species are tracked include poultry (chicken and turkey, pork, and beef. The overall findings for Campylobacter species in poultry suggest the amount of samples with detectible amounts Campylobacter trended downwards until 2010, when there was an increase in 2011 from 40% to 46% in retail chicken and 2%-4% in retail turkey (FDA, 2013). Interestingly, similar studies between conventional and organic poultry found mixed results. A literature review by Smith-Sprangler et al. (2012) found in chicken, 67% of organic samples and 64%, with similar confidence intervals, of conventional samples were contaminated with Campylobacter. A follow-up study disagreed and found conventionally raised chicken contained 4.8 Log_{10} CFU/mL of *Campylobacter* while the organic brands contained lower amounts at 3.4 Log10 CFU/mL (Hardy et al., 2013). Additionally, Hardy et al, found that organic turkey had higher bacterial counts of Campylobacter than conventionally raised brands. Salmonella is the leading cause of food-borne illness worldwide and one of the main modes of infection is through contaminated food (FDA, 2013; Glenn et al., 2013). The findings for Salmonella are similar with highest percentage of meat products with Salmonella detected was turkey at 13% followed by chicken 12%, beef 1%, and pork at 3% (FDA, 2013). These figures are supported by additional, outside studies that have Salmonella being detected in and 34% in chicken samples and 5% (range, 0% to 39%) in pork samples (Smith- Sprangler et al., 2012). Research has also evaluated if organically raised meats have lower percentages of Salmonella detected than conventionally raised meats. As with the findings of Campylobacter, studies reported mixed results with the number of meat samples with Salmonella, 35% of organic samples, and 34% of conventional samples (Smith-Sprangler et al., 2012). Hardy et al. (2013) found positive detected samples; conventionally raised chicken contained 4.7 Log_{10} CFU/mL of *Salmonella* while the organic brands contained lower amounts at 3.1 Log10 CFU/mL. Lastly, for *Escherichia coli* the findings are mixed for both conventional and organic and in line with studies of *Campylobacter* and *Salmonella*. According to Stuart et al. (2012), antibiotic resistant *Escherichia coli* was found in 100% of all conventional meat samples and 84% of all organic samples while Smith-Sprangler et al. (2012) found higher levels of *Escherichia coli* in organic samples 65% versus 49% in conventional samples.

Additional bacterial species have been identified as opportunities to be transmitted through consumption of contaminated meat and not currently tracked through the United States Department of Health and Human Services NARMS survey and have therefore been studied in individual studies for *Staphylococcus aureus*. Both of these are clinically significant in humans and able to cause infection/ disease. *Staphylococcus aureus* is able to cause a range of infections from food-borne illness, skin infections, and can cause serious invasive infections and death. The research community is evaluating different routes of how human *Staphylococcus aureus* colonization and infection is related in husbandry practices. The primary finding is that S. aureus has contaminated a considerable proportion of all meat and poultry samples tested (37–77%), with a concerning 52% of isolates being resistant to multiple antibiotics (Waters et al., 2011). When looking at the number and percentage of *Staphylococcus aureus* isolates found between organic and conventional meat samples, there have been mixed results with a slightly higher number of isolates identified in conventional samples (Hardy et al., 2013) which has also been found in approximately 58% of conventional samples and six percent of organic samples (O'Brien et al., 2012).

In conclusion, there is currently a lack of consensus in the literature regarding what benefits organically raised meat offers to the consumer. The studies looking at both bacterial counts and percentage of meat items with antimicrobial resistance bacteria are mixed. This finding has also expanded to literature reviews at the organism level with Smith- Sprangler et al. (2012) finding the risk for isolating bacteria resistant to three or more antimicrobial agents was 33% higher among conventional chicken and pork than organic alternatives. Interestingly, there have been studies that found bacteria isolated from organic retail meat might have lower amounts of bacteria resistant to antimicrobials, with differences being statistically insignificant (Kavvalakis & Tsatsakis, 2012).

Additional studies have seen increase antibiotic resistant bacteria on conventional retail meat (Brandt et al., 2011; Forman et al., 2012; Huber et al., 2011; Palupi et al., 2012; Smith-Spangler et al., 2012). At this time, it appears the amount of bacteria found on retail meat is not depended solely from the husbandry practices but there may be a higher risk of exposure of antibiotic resistant bacteria from conventionally raised livestock. While there may still be a benefit from organically raised meat, at this time the literature has been unable to provide definitive evidence supporting this.

Produce

Produce has been the primary concern and source of OP exposure in the food supply. The United States Environmental Protection Agency (EPA) regulates exposure to pesticides in food by setting a tolerance limit, which is the maximum amount of pesticides that may legally remain in or on food and animal feed. The EPA releases a report, approximately annually, that analyses pesticide residue in a sample of domestic and import produce, among other food items. The Pesticide Data Program (PDP) is mainly used for risk assessments and therefore has a rigorous methodology and reports even any detectable levels of pesticide residues, even when those levels are well below EPA tolerances. Prior to testing, each produce item was washed for 15-20 seconds under cold water as would be done by a consumer (USEPA, 2014). While none of the items tested were above the EPA tolerance, nearly two-thirds of the 3,015 produce samples tested in 2013 contained at least one pesticide residue (EWG, 2014; USEPA, 2014).

The consensus for studies that evaluated pesticide levels between organic and conventionally grown produce, was conventionally grown produce had higher levels than organic. Smith-Spangler et al. (2012) found the pesticide contamination in conventional produce was 30% than organic produce. This finding was supported by Kavvalakis and Tsatsakis (2012), who found detectable pesticide residues in 7% of organic produce samples and 38% of conventional produce samples. The overall body of literature has identified that some fruits and vegetables have higher concentrations of pesticides than others do. According to the Environmental Working Group (EWG) in the 2014 Pesticide Data Program's (PDP) report nearly all apples, peaches, and nectarines tested positive for at least one pesticide and six other fruits and vegetables testing positive for 13 or more pesticides. As a consumer advocacy group, Environmental Working Group (EWG) also reports out the “Dirty Dozen” which are the top twelve fruits and vegetables with the highest pesticide loads. For 2015, the Dirty Dozen, ranked by pesticide load, includes: apples, peaches, nectarines, strawberries, grapes celery, spinach, sweet bell peppers, cucumbers, cherry tomatoes, snap peas, potatoes, and hot peppers. Pediatricians have also received guidance from the APA to provide this list to parents when considering purchasing organic produce for their children and which produce items may harbor the highest risk of pesticide exposure (Forman et al., 2012).

Whereas the literature supports organic produce items reduce the risk of pesticide exposure, it does not support it provides a health benefit. In the last fifteen years, the focus has been on determining if organically cultivated crops were more nutritious than their conventional counterparts. Some of the specific areas of interest have includes Vitamin C, carotenoids, and phenolic compounds. Higher levels of vitamin C have been found in organic peaches, tomatoes (Huber et al., 2011), spinach, lettuce, and chard

(Forman et al., 2012) than conventional items. However, the same levels or lower amounts of vitamin C were found in broccoli and bell peppers (Huber et al., 2011). Some studies found higher levels of Vitamin C in organic some food items, fruits and vegetables (Brandt et al., 2011; Kahl et al., 2012; Lima & Vianello; 2011) while Smith-Spangler et al. (2012) study did not find any significant differences in Vitamin C levels in any of the fruits and vegetables reviewed. Caretenoids include beta-carotene, lycopene, lutein, and zeaxanthin are antioxidants and believed to have beneficial effects on health. Smith-Spangler et al. (2012) did not find a significant difference in beta-carotene between organic and conventional produce. A number of additional studies comparing total carotenoids content of between a variety of organic and conventionally grown crops have been conducted: green cauliflower, tomatoes, sweet red bell pepper, grapefruit, grapes, apples and carrots and concluded almost no significant differences in content of total carotenoids of any type found (Johansson, Hussain, Kuktaite, Andersson, & Olsson, 2014).

Subsequent studies did not continue to focus on Vitamin C due to the lack of association in the literature. Similarly, as for the above mentioned Vitamin C and total carotenoids, a large number of studies compared total levels of phenolics as well as individual phenolic compounds for variety of both fruits and vegetables. While a few studies found phenolic acids to be higher in organic food about 60 percent to 80 percent of the time (Brandt et al., 2011). Examples of crops which evaluated total phenolics in organic and conventional farming systems include potatoes, strawberries, blueberries, peach, pear, apple, kiwi, tomatoes, leaf lettuce, and collards with no significant differences (Johansson et al., 2014). However, individual phenolic compounds are higher in organic versus conventional crops for some of the same food items, collard greens, blueberries, peaches, and pears in other studies (Capuano et al., 2013). Possible explanations for the lack of consensus in the literature range from lack of a gold standard to measure “healthiness” in produce. More broad explanations include the geographic location of the crop, soil characteristics, climactic conditions, the season, and the maturity of the crop. At this time, however, there does not appear to be convincing body of evidence to support a significant difference in nutritional quality of organic versus conventional produce.

The results of these systematic reviews and meta-analysis had the following key findings: (1) the risk for contamination with detectable pesticide residues was lower among organic than conventional foods but amounts and degree of significance varied by food item, (2) conventional chicken and pork have a higher risk for contamination of resistant bacteria than organic counterparts. (3) The evaluation of GH in bovine milk has determined no added adverse risk to health. Key findings on health benefits include: (1) produce no significant differences in nutrients studied; (2) milk has the same protein, vitamin, trace mineral, and lipids from both organically and conventional cows and growing evidence that organic milk has a higher concentrations of antioxidants and polyunsaturated fatty acids; and (3) conventionally reared meat have higher concentrations of antibiotic resistant bacteria than organic (Brandt et al., 2011; Forman et al., 2012; Huber et al., 2011; Palupi et al., 2012; Smith-Spangler et al., 2012).

Organic versus Conventional Diet

The research community has been unable to come to consensus with some studies finding both health and safety benefits of organic produce and livestock products. Individual studies have found mixed results with meta-analyses citing some possible benefits of organic food items, but those finding not being statistically significant. The consensus in the literature is there is currently a lack of evidence that organic food items offer significant health benefits but there are also limitations in study methodology (Aschemann-Witzel et al., 2013; Barański et al., 2014). The recommendations for future research on this topic include the necessity to eliminate outside factors that may contribute or bias the results between organic and conventional food studies to eliminate or minimize their effect (Forman et al., 2012; Smith-Sprangler et al., 2012). Other suggestions include that organic food(s), as a whole, do not have a placebo for comparison or include any well-powered human studies that directly demonstrate health benefits or disease protection as a result of consuming an organic diet and therefore it is difficult to support or access health claims (Kahl et al., 2010; Lima & Vianello, 2011; Kahl, Zalecka, Ploeger, Bugel, & Huber, 2012; Zalecka et al., 2014). To address this gap, a variety of studies have tested OP levels in individuals who consume an organic and conventional diet to help demonstrate the possible health benefits of an organic diet.

The studies that have assessed OP DAP metabolite levels have found with statistical significance that DAP metabolite levels are lower than those found in individuals consuming a conventional diet. Both small longitudinal and larger national studies have found that for individuals who consume a mainly organic diet, urinary pesticide residues were reduced to almost non-detectable levels (below 0.3 µg/L) Forman et al., (2012). In another study by Kavvalakis and Tsatsakis (2012), found DAP metabolite levels for an organic diet is 4.8 parts per billion (ppb) while levels for a conventional diet were 41 ppb. According to Kavvalakis and Tsatsakis, the DAP metabolite levels in children specifically found the levels were 4.3 ppb for conventional diet and 0.8 ppb in organic diets that has been supported by subsequent studies that found significantly lower DAP levels for those children who consumed an organic diet (Curl et al., 2015; Oats, Cohen, Braun, Schembri, & Taskova, 2014) . Several studies, including the EPA, have suggested that the dietary consumption of OP pesticides represented a major source of exposure in children (ACOG, 2013; Curl et al., 2015; Forman et al., 2012; USEPA, 2014).

There is sound evidence that organic diets are less likely to expose consumers, especially children, to pesticides associated with human disease. Nontherapeutic use of antibiotic agents used in conventional husbandry contributes to the emergence of resistant bacteria in retail meat products. Therefore, organic animal husbandry may reduce the risk of human disease attributable to resistant organisms. While the research community is continuing to explore the topic what research has found is organic food items reduced OP exposure in all individuals who consume an organic diet and may have significant health benefits in neonates and children.

While the research may have equivocal findings, the related research concerning Consumers found they believe that organic produce is more nutritious than conventionally grown produce. Organic food consumers are looking for a product free from pesticides and characterized by a higher nutritional quality (Aschemann-Witzel et al., 2013; Kahl, 2012; Kahl et al., 2012; Luthria et al., 2010). Despite the large body of evidence that supports consumer support for organic food items, these foods are generally more expensive than their conventional counterparts are. Additional research has suggested, consumers with a low socio-economic status (SES) may experience financial barriers to healthy eating (Drewnowski, 2004; Waterlander et al, 2010). Further, cost inhibits healthy eating as energy dense, high fat foods are often less expensive, and more accessible, than healthier alternatives (Cassady, Jetter, & Culp, 2007). As such, food prices may contribute to health inequalities in diet-related diseases with lower SES communities with disproportionally high rates of disease. Evidence also suggests that reductions in price barriers influence consumer food choices and that discounts and food subsidies increases healthy food purchasing habits (Pearson et al., 2014). Several studies have evaluated food purchasing habits of lower SES and have suggested food pricing strategies are associated with pro-health outcomes.

Barriers to Eating a Healthy Diet

Researchers are seeking to examine reasoning behind consumer food choices and possible barriers affecting food purchases in order to understand further what prevents individuals from consuming nutritious foods in the recommended quantities. Each of these is a dynamic topic with a range of variations based on socioeconomic, geographic, and cultural characteristics. As such, the research has been conducted at local, state, regional, national, and global levels to better understand whom obesity affects and identify common factors which could be utilized for more focused research.

Currently, the research supports the finding that those of lower socioeconomic standing are at higher risk for obesity than those of higher socioeconomic standing (Drewnowski et al., 2013; Zhang, Camhi, Shi, & Hayman, 2013). However, the research has also demonstrated that obesity rates vary widely by gender, geographical location, socioeconomics, ethnic backgrounds, and age (Ogden & Carroll, 2010; Ogden et al., 2012; Ogden et al., 2014). In the wake of this, research has been exploring factors that may cause and influence this phenomenon. The results of the research suggested that those of lower socioeconomic status experience a variety of barriers in obtaining and purchasing nutritious food items (Drewnowski, 2012). The research suggested that those of high socioeconomic status and higher education levels consumed more nutritious items overall (Drewnowski et al., 2013; Zhang et al., 2013). Those with higher levels of education, but not necessarily higher socioeconomic levels, demonstrated increased preference for and purchased more specific nutritious food items, such as organic, more frequently compared to those of lower socioeconomic status (Zepeda & Li, 2007; Researchers are exploring physical barriers to obtaining nutritious food items such as access, availability, and pricing in order to examine factors that increase the risk of obesity among those with lower socioeconomic status. Additionally, researchers are investigating the disparity food purchasing habits between those of lower socioeconomic or educational levels and those of higher socioeconomic and educational levels. At present, the body of literature suggests the primary barrier to eating a healthy diet is the cost of nutritious food items (Drewnowski, 2010; Monsivais et al., 2012). To provide additional insight into where Americans purchase their food, in 2003 NHANES began coding all foods consumed by NHANES participants by purchase location which include stores (such as grocery, convenience, or specialty), quick-service restaurants, full-service restaurant, workplace/ school cafeteria, vending machine, from another individual, grown, or other (Drewnowski et al., 2013). When assessing food purchasing options of consumer, the NHANES did not separate “store” into a more descriptive category but it included locations such as grocery stores, supermarkets, convenience stores, and specialty food stores. The majority of foods purchased from stores would presumably come from grocery stores and supermarkets; other studies have explored how “stores” might be categorized, and provide a methodology to identify and categorize to facilitate research efforts.

Several studies categorize “store” into grocery store (large, medium, and small), supermarket, and convenience store. Grocery store size is defined as (a) small sized grocery store is an independent food stores between 1,000 and 2,500 square feet, (b) medium sized grocery stores is approximately 15,000-39,999 square feet and stocks a limited number custom-brand items, and (c) Large grocery stores/ supermarket range from 40,000 to 80,000 square feet and typically include additional services such as a delicatessen, pharmacy, and general merchandise in addition to groceries (Martin et al., 2014). Studies have found that large grocery stores/ supermarkets tend to offer the largest variety of healthy food items at the lowest price (Drewnowski et al., 2013; Glanz et al., 2007; Morland et al., 2006; Powell et al., 2007).

Access to Organic Food Items

Interestingly, there are differences in cost are of nutritious foods even at large grocery stores (Drewnowski et al., 2012) and significant price differences between organic and non-organic food items (Capuano et al., 2013; Drewnowski et al., 2012). One research area currently explored is the ability of individual consumers to purchase organic foods. The current body of literature suggests not all consumers have equal access to organic food items and, therefore, may not have equality ability to consume them as part of a daily nutritious diet (Curl et al., 2013). Organic food is also more expensive than conventional food items that may result in a disparity in the cost of organic items for the consumer. The difference in price can have a negative consequence to health as research suggests individuals with better access to healthy food items tend to have healthier diets (Capuano et al., 2013). According to Forman et al. (2012) a major concerns for the food consumer is the higher price for organic food items with the average cost increase of 10%-40% more than similar conventional food items.

It is possible that not all communities have equitable access to organic food items. Despite the increased cost of organic foods, within consumer studies there has been increased interest, by consumers, in purchasing organic food items. Increased consumer demand for organic food items is thought to be due to the growing perception that organic food provides a healthier food choice (Aschemann-Witzel et al., 2013; Capuano et al., 2013; Jensen et al., 2012). Of potential concern is the higher price of organically produced produce and meat items may lead consumers to eat less of these foods, despite the research literature supporting the health benefits. While the scientific community may not be able to provide a consensus of a superior nutritional option, there is a consensus that organic food items reduce exposure to pesticides and may decrease diseases associated with antibiotic resistant organisms (Capuano et al., 2013; Forman et al., 2012; Smith et al., 2015).

Role of WIC (Women, Infants, and Children)

The Women, Infants, and Children (WIC) program was designed as a special supplemental nutrition initiative to promote health for pregnant, breastfeeding, postpartum women, infants, and children up to the age of five (United States Department of Agriculture (USDA, 2014d). WIC was established in 1972 through an amendment to the Child Nutrition Act of 1966 and is managed by the Food and Nutrition Service (FNS) of the US Department of Agriculture (USDA). The benefits offered by WIC include nutrition education counseling, breastfeeding promotion and referrals for medical care, social services, and supplemental community programs. The WIC program has specific goals for pregnant women, postpartum women, infants/ children to promote overall health and reduce the incidence of negative health outcomes. Specifically, to improve fetal development and reduce incidence of low birth weight, pre-term deliveries, anemia in pregnant women during the prenatal period; to promote breastfeeding and nutritious diets to improve overall health in post-partum women; and provide nutritious foods during critical periods of growth and development to promote overall health and prevent diet associated health problems. Eligibility into the WIC program is based on income eligibility, risk for poor nutrition, and categorized as a pregnant, breastfeeding, or postpartum woman; an infant up to the age of one year; or a child of one year through first birthday. Individuals who are approved to receive supplemental food items, typically distributed as vouchers or an Electronic Benefits Transfer (EBT) card, such as milk, fruits, and vegetables from participating food vendors at no charge (USDA, 2014c).

According to Johnson et al. (2012), in April 2012, 9.7 million participants were enrolled in WIC with the full fiscal year 2012 cost of the program was $6.8 billion. WIC is not an entitlement program (Johnson et al., 2012). According to the CDC, between 2008 and 2011, significant decreases were reported preschool-aged children participating in federal nutrition programs in 18 states and the US Virgin Islands. The absolute decreases ranged from 0.3 to 2.6% (CDC, 2013a).

Study Setting: Los Angeles County, California

Los Angeles has a diverse demographic, socioeconomic, and range of health disparities that provides a unique opportunity to explore the multidimensional construct of accessibility to not only to organic food items, but also cost and variability. As of 2013, Los Angeles County has a population of 10,017,068 and a poverty rate of 17% and 27% for children. The poverty rate in LA is higher than the state of California and the United States rates (U.S. Census Bureau, 2015). The 2013 median household income in L.A. was estimated at $55,909, which is less than the California State average and a bit higher than the average for the United States. However, the cost of living in Los Angeles County for 2012 was 129.4 with the United States average of 100 (U.S. Census Bureau, 2015).

California is also the top agriculture-producing state in the nation, grossing $38 billion in revenue from farm crops in 2010 (CDPH, 2010) with approximately 200 million pounds of active pesticide ingredients used in California each year (California Department of Pesticide Regulation [CDPR], 2014). Since 1990, California has required commercial application of agricultural pesticides report to the CDPR that publically reports the data. California is not only a leader in conventional agriculture, but also organic farming practices as well. According to Klonsky (2010), California accounts for 19% of all organic farms and 39% of all organic sales.

The use of Los Angeles County as a study location provides a unique opportunity to explore access organic food item that is not only the leading producer of agriculture, but also has a largest WIC participation in the country. According to PHFE WIC (2015) in 2014, WIC served nearly 600,000 individuals in Los Angeles County or approximately 67% of all infants and about half of all children ages one to five each month. Based on the US Census data (2015) the total population of children under five years of age in LA County is 641,092 with the total WIC population under five being 393,417 with pregnant or post-partum women at 95,998 (PHFE WIC, 2015). The children serviced by WIC have been predominately of Hispanic origin with 2014 data breakdown at 82% Hispanic, 8% African-American, 4% Caucasian, 4% Asian, and 2% others (PHFE WIC, 2015).

Summary and Transition

Understanding the variables that make-up the consumer food environment and contribute to obesity and other negative health effects is a public health priority. Consuming a healthy diet, as defined by the 2010 Federal Dietary Guidelines for Americans (USDA; 2010), and maintaining a healthy weight are components in reducing the risk for obesity and related negative health outcomes. Reduction of exposure to pesticides by consuming an organic diet (Curl et al., 2015; Forman et al., 2012; Maffis, 2014; Roberts et al., 2012; Sathyanarayana et al., 2012), may reduce the risk of cognitive impairment and other negative health outcomes in children (ACOG, 2013; Bouchard et al., 2011; Engel et al., 2011; Furlong, Engel, Barr, & Wolff, 2014; Liu & Schelar, 2012; Shelton et al., 2014). In addition, an organic diet may also reduce the exposure of antibiotic resistant bacteria found in conventional meat products (Brandt et al., 2011; Forman et al., 2012; Huber et al., 2011; Palupi et al., 2012; Smith-Spangler et al., 2012). The literature suggests the primary barrier to eating a healthy diet is the cost of nutritious food items (Drewnowski, 2010; Monsivais et al., 2012). When evaluating food retailers, studies have found that large grocery stores tend to offer the largest variety of healthy food items at the lowest price (Drewnowski et al., 2013; Glanz et al., 2007; Morland et al., 2006; Powell et al., 2007). The barriers to eating a healthy diet is similar to the barriers to eating an organic diet with organic food items being more expensive than their conventional counterparts (Capuano et al., 2013; Drewnowski et al., 2012) and may not be equally accessible to all consumers (Curl et al., 2013).

With Los Angeles County accounting for 33% of all California's WIC recipients (PHFE WIC, 2015), an understanding of the availability, variability, and pricing of organic food items is needed. The currently literature has focused on the availability and affordability of conventional food item. No known study has looked specifically at the availability, variability, and price of organic food items in high and low-income areas. A study that compares these factors between areas of high and low-incomes is needed to identify is a disparity between high and low-incomes exists.

Summary and Transition

The research design and methodology used in this study is detailed in Chapter 3. Additional information of the population, sample size, instrumentation procedure, and data analysis will also be discussed in the next chapter.

Chapter 3: Research Method

Introduction

The purpose of this study was to compare the variability and price of organic and conventional food items from the WIC food list in grocery store chains with locations in of both high- and low-income communities. I used the NEMS-S to evaluate both organic and conventional food items in all stores surveyed. I conducted data analysis using a chi-square test, independent *t* tests, and ANOVA. In this chapter, I provide a description of the study design, instrumentation, and data analysis I used to assess the variability and price of organic and conventional food items from chain grocery stores located in both high- and low-income areas. Additionally, I describe my sample section, data collection tools, data collection procedures, and the statistical methodology I chose for data analysis.

Research Design and Rationale

I chose the research design and rationale for two reasons: (1) to provide a reliable, valid methodology and tool to address the research questions, and (2) to address the gap in the literature regarding organic and conventional food prices in chain stores of high- and low-income socioeconomic areas. I employed the NEMS-S tool to determine price and variability of both organic and conventional food items (as drawn from the WIC food list) in the chain grocery stores in predefined areas of high and low-income in Los Angeles County, CA. To address the literature gap, I found that additional research was needed to compare both organic and conventional food costs and variability between high and low-income areas in order to determine if access barriers exist.

In this study, I used a quantitative cross-sectional design to test the variability and prices of food basket items at large chain grocery stores. My choice of quantitative method was justified because the purpose of the study was to evaluate a possible correlation between the following study variables: (1) standard pricing, (2) organic food basket items, and (3) conventional food basket items. The timeframe for data collection was 4 weeks, and I included a random sampling of large chain grocery stores authorized by California WIC in Los Angeles County (CDPH, 2015). The study area of Los Angeles County, CA includes 4,058 square miles with approximately 1097 WIC authorized vendors (U.S. Census Bureau, 2015; CDPH, 2015). This cross-sectional design offered the best method for determining the relationship of a random population, at that point in time, and the ability to carry out research in natural settings (Frankfort-Nachmias & Nachmias, 2008). My study did not need to demonstrate a direction of correlation, but rather that a correlation existed between variables. Therefore, the weaknesses of this design are acceptable (Frankfort-Nachmias & Nachmias, 2008). This study did not intend to manipulate independent variables because it is not seeking causation. I addressed the possible influence of selection and treatment using random samples of the population conducted during a set point in time. I surveyed a random sample of an equal number of large chain grocery stores in areas of high- and low-income.

The food items included were derived from the California WIC Authorized Food List Shopping Guide (CDPH, 2011). I assumed that the food items would be available throughout the year. The WIC Authorized Food List Shopping Guide is provided to WIC recipients, and functions as a guide on what varieties of foods, and even specific food items, are approved under the program (CDPH, 2011). The WIC Food Database was written and published for WIC recipients in California and includes information regarding what specific brands and sizes are approved. For this study, I used both the WIC Authorized Food List Shopping Guide and the WIC food database to identify food items to be surveyed. The WIC Food database is not an exhaustive list of approved items but is provided to recipients to facilitate identification of approved foods. I used the WIC Authorized Food List Shopping Guide in tandem with the database to provide a comprehensive list of approved items and ensure they were placed in the appropriate food category (CDPH, 2011). The food categories included in the WIC Authorized Food List Shopping Guide are milk, cheese/eggs, soy/ tofu, whole grains, breakfast cereal, peanut butter/beans, bottled/concentrated juice, fruits/vegetables, and infant food items.

Additionally, I used the median demographics of an approved WIC recipient as the criteria used to determine which specific food items would be included in the WIC food basket. Based on the criteria provided by WIC, I randomly drew food items from each category approved by the median WIC recipient. The socioeconomic status of the geographical regions, or neighborhood, was an independent variable with two levels: low socioeconomic and high socioeconomic status with dependent variables including variability and price (organic food variability score). I determined income levels of the geographical areas/neighborhoods by the income level of the WIC median family demographic. According to the U.S. Census Bureau (2015), WIC eligibility is classified as less than 200% of the Federal poverty level (FPL) for low-income, 200%–399% for middle-income, and greater than 400% high-income. For Los Angeles County, the

Federal Poverty Level is $23,850 (for a family of four). For a WIC recipient to be approved, the family must not exceed 185% of the FPL or less than or equal to $44,123 per annum (U.S. Census Bureau, 2015; CDPH, 2011). High-income would therefore be greater than or equal to 400% FPL or greater than or equal to $95,400 per annum. I used this census stratification to define low- and high-income outcome measures.

The interactive website Rich Blocks, Poor Blocks (2015) uses the U.S. Census Bureau's American Community Survey to provide current data on the median income for individual census tracts. The map provided by Rich Blocks Poor Blocks uses the 2000 U.S. Census Bureau tract map and incorporates the data compiled from the 2007-2011 American Community Survey to show median household income and monthly rents by census tract (Rich Blocks Poor Blocks, 2015). I used Rich Blocks, Poor Blocks (2015) to gather census tract and median income information. To gain further insight into the demographics of each geographical area that I surveyed, I additionally used Mapping L.A. Neighborhoods. This is an interactive map created by the Los Angeles Times (2010) used the 2000 U.S. Census Bureau's boundaries and tracts as a foundation but has made adjustments to better align with the subsequent maps produced by the Los Angeles County Department of Regional Planning, and was last updated in 2011. In addition, Mapping L.A. Neighborhoods includes ethnicity, education, age, marital status, housing, and other miscellaneous demographic data. In sum, I used Rich Blocks, Poor Blocks (2015) for census tract and median income information, and Mapping L.A. Neighborhoods for additional demographic information regarding the areas surveyed.

Research Questions

The overarching question for this study was how does the cost and variability of the WIC Food basket (of organic vs. non-organic foods) differ in large chain grocery stores across socioeconomic areas (high- and low-income) of Los Angeles County, CA? This overarching question led me to construct the following research questions (RQs) and associated hypotheses:

RQ 1: Do large chain grocery stores located in low-income neighborhoods have the same organic food availability as large chain grocery stores located in high-income neighborhoods?

$H1_0$: Large chain grocery stores located in low- income neighborhoods, defined as census tracts with income level less than or equal to $44,123 per annum, will have the same organic food availability as large chain grocery stores located in high-income neighborhoods, as defined by census tracts with income levels of greater than or equal to $95,400 per annum.

$H1_a$: Large chain grocery stores located in low- income neighborhoods defined as census tracts with income level less than or equal to $44,123 per annum, will not have the same organic food availability as defined by the WIC food basket, as large chain grocery stores located in high-income neighborhoods, as defined by census tracts with income levels of greater than or equal to $95,400 per annum.

RQ 2: Do large chain grocery stores located in low-income neighborhoods have the same price points for organic and non-organic food items included on the WIC food basket as large chain grocery stores located in high-income neighborhoods?

> $H2_0$: Large chain grocery stores located in low-income neighborhoods defined as census tracts with income level less than or equal to $44,123 per annum, will have the same price points for organic and non-organic food items, as defined by the WIC food basket and measured by the NEMS-S, as large chain grocery stores located in high-income neighborhoods, as defined by census tracts with income levels of greater than or equal to $95,400 per annum.
>
> $H2_a$: Large chain grocery stores located in low- income neighborhoods defined as census tracts with income level less than or equal to $44,123 per annum, will not have the same price points for organic and non-organic food items, as defined by the WIC food basket and measured by the NEMS-S, as large chain grocery stores located in high-income neighborhoods, as defined by census tracts with income levels of greater than or equal to $95,400 per annum.

RQ 3: Is there the same variability of organic and non-organic food items, as defined by the WIC food basket, available at both high and low-income neighborhood large chain grocery stores?

H3$_{0:}$ Large chain grocery stores located in low- income neighborhoods, defined as census tracts with income level less than or equal to $44,123 per annum, will have the same food item variability for organic and non-organic food items, as high-income levels defined by census tracts of greater than or equal to $95,400 per annum.

H3$_{a:}$ Large chain grocery stores located in low- income neighborhoods, defined as census tracts with income level less than or equal to $44,123 per annum, will not have the same food item variability for organic and non-organic food items, as high-income levels defined by census tracts of greater than or equal to $95,400 per annum.

Methodology

Participants/ Sample

The participants for this study were large grocery store chains located inside the defined boundaries of Los Angeles County. The final sample of large chain grocery stores was selected from participating WIC food vendors located in high and low-income census tracts. The selection of participants is based on two criteria. As a primary focus of this study was the WIC recipient, the WIC Authorized Vendor list was utilized to provide food retailers that are currently partnered and service the WIC program. From the WIC Authorized Vendor list, food retailers that meet the study definition of large grocery chain stores were identified within Los Angeles County, and constituted a potential participation population.

To determine the final sample population pool, all potential stores were assessed and categorized by income level of census tract location. Those stores that meet high and low-income criteria will be included in the final participant sample pool for the study. The census tract income level of each store surveyed was used as a construct, but not as part of the population being studied directly in the study. With this said the study could not ensure the shoppers themselves are of high or low socioeconomic status only that the store was located in a high or low socioeconomic area.

Grocery Stores

This study limited the scope of the study to large grocery stores/ supermarkets as the literature supports they tend to offer the largest variety of healthy food items at the lowest price (Drewnowski et al., 2013; Morland et al., 2006). The grocery stores included in the study were selected from food retailers currently partnered with the California WIC Program (CDPH, 2015). The California WIC Program publishes a list of partnered food retailers in the WIC Authorized Vendor List. However, the vendor list did not indicate the type or size of the store. To address this limitation, each vendor listed was categorized. Only those vendors that met large grocery store criteria were included.

There has been some disagreement in the literature as to how to define a large grocery store chain. Earlier research by Chung and Myers (1999) defined a large grocery store chain as one that is part of a franchise system where several stores in the local area affiliated, typically under the same name. The study by An and Sturm (2012), adopted the North American Industry Classification System (NAICS), used by the U.S. Businesses in InfoUSA, to classify grocery stores. The NAICS defined midsize grocery stores as having annual sales $1–$5 million and large supermarkets as annual sales greater than $5 million (An & Sturm, 2012). This study used the NAICS classification system as a component of the large chain grocery store definition used in this study.

Several outside studies have categorized “store” into grocery store (large, medium, and small), supermarket, and convenience store (Andreyeva et al., 2008; Drewnowski et al., 2013; Hilmers, Hilmers, & Dave, 2012; Martin et al., 2014). Grocery store size is defined as: (a) small sized grocery store is an independent food stores between 1,000 and 2,500 square feet; (b) medium sized grocery stores is approximately 15,000-39,999 square feet and stocks a limited number custom-brand items; and (c) large grocery stores/ supermarket range from 40,000 to 80,000 square feet and typically include additional services, such as a delicatessen, pharmacy, and general merchandise in addition to groceries (Martin et al., 2014). This study adopted this categorization system to provide an additional dimension to the study definition of large grocery store. This addition expanded the definition to include grocery stores that may not be classified with annual sales less than $5 million but would be classified as a large grocery store using criteria utilized by other related studies (Havens et al., 2012; Martin et al., 2014; Zhang, M., & Ghosh, D., 2015).

After a participant sample pool of large chain grocery stores had been complied using the inclusion criteria, outlined above, they were classified based on the mean income of the census tract they were located in. Each included large chain grocery store that was evaluated to determine the mean income level of the census tract they were located in. Rich Blocks Poor Blocks (2015) is an on-line interactive map that displays a geographical area by the census tracts designated by the U.S. Census Bureau and displays the mean income for each census tract. Rich Blocks, Poor Blocks employs the 2000 U.S. Census Bureau tract map and incorporates the data compiled from the 2007-2011 American Community Survey to provide demographic data for each census tract. The Rich Blocks, Poor Blocks interactive map was used to classify the mean income of the census tract each included large chain grocery store is located in. The stores located in census tracts meeting the mean income criteria for high-income (greater than or equal to $95,400 per annum) and low-income (less than or equal to $44,123 per annum) were used to draw the participant grocery stores used in the study. Of the grocery stores meeting the inclusion criteria (WIC authorized vendor, located in Los Angeles County, categorized as a large chain grocery store, and located in a high or low-income census tract), a total of 54 stores (27 located in high-income census tracts and 27 located in low-income census tracts) were surveyed for the study.

Sampling and Sampling Procedures

The dissertation study method was quantitative using a cross-sectional design. A random sampling approach was used. The geographical area is the boundaries of Los Angeles County. Equal samples sizes from high and low-income grocery stores were attempted. The large chain grocery stores surveyed did not include a complete representation of all of the large chain grocery stores that were located in the geographical areas surveyed. Therefore, the large chain grocery stores that were selected this study were randomly selected from the sample of stores that met the inclusion criteria.

To determine the number of stores needed, a prospective or priori power analysis was conducted. The sample size for the study was determined after identifying the alpha value [alpha = 0.05] and power level [power = 1-β] for this study (Ellis, 2010). The alpha value is the probability of making a false positive result (Type I error). The power level is of the probability of making a false negative result (Type II error) (Ellis, 2010) 1995) and can be determined by identifying the type of statistical tests performed. The overreaching goal of this study was to compare the differences between two means (differences between organic and conventional food items and the differences between stores located in high and low-income areas). The standard accepted alpha value is 0.05 and a power level were [power = 1-β] of 0.80 (Motulsky, 1995). The effect size of 0.8 (large effect size) was selected to provide the appropriate threshold to evaluate if a large difference exists between the independent samples (Ellis, 2010). As such, a large effect size (0.80) suggest the results are not just due to chance and the observed result is due to the interaction of the two groups being evaluated (Trochim, 2006). To calculate the sample size, a priori for a *t* test difference of two independent means two-tailed were used. The software program G*power 3.1.7 was used to calculate the input needed to analyze the data sets using a large effect size of 0.8, an alpha of 0.05, and beta/ power of 0.80. After calculating the various inputs, each minimum sample size was 26 with a total minimum sample size of 52. The total sample size selected for this study was 54 with 27 in each sample to ensure the minimum sample size was met even if one or two stores could not be successfully surveyed. In the event, the minimum sample size of 52 cannot was not met, the characteristics of the missing store type would have been matched with a surveyed store.

Instrumentation and Materials

On-line training was completed May 2015 to understand the process and procedures for the use of the NEMS-S instrument. The training materials included Power Point presentations, practice examples, and assessments (Glanz, Clawson, Davis & Carvalho, 2008; Honeycutt, Davis, Clawson & Glanz, 2010). After completing the course, a training certificate was provided along with on-line access to additional training materials and resources.

According to Glanz et al. (2008), it is important to conduct surveys during a consistent time frame with the recommendation being to survey between the hours of 9:00am and 4:00pm in order to ensure food items have been stocked for the day and to reduce food items to be out of stock. The surveys were conducted during a four week period interval to address the distance to be covered across Los Angeles County and the average of 42 minutes per survey in large grocery chains (variance of 33-60 min). Lastly, the NEMS-S procedures used to complete the surveys can be found in Appendix A.

The goal of using the NEMS-S instrument was to provide a tool that has already demonstrated in previous studies to provide both high validity and reliability in the literature (Andreyeva et al., 2012; Franco et al., 2008; Glanz et al., 2007; Krukowski et al., 2010). The NEMS-S instrument was developed in 2004 to explore the availability, price, and quality of healthy food items in retail food vendor environment utilizing ten food item categories (Glanz et al., 2007). The tool was also evaluated for inter-rater reliability and test-retest reliability in grocery stores of varying income levels and community configuration in the Atlanta metro area. The NEMS-S instrument was found to have a high degree of both inter-rater reliability (kappa of 0.84-1.00) and test-retest reliability (kappa of 0.73-1.00) across all ten food categories (Glanz et al., 2007).

Firstly, I adapted the store inventory instrument from the validated NEMS-S measure (Glanz, et al., 2007) and tailored it to align with the WIC Authorized Food List (Andreyeva et al., 2011 ; CDPH, 2011) as proxies for regular foods and replaced healthy foods for organics. Secondly, the fruit and vegetable items were expanded to include the 2015 Dirty Dozen (Forman et al., 2012) and align with the research literature on food items where organic options may be more healthful. The instrument included milk (5: whole, 2%, 1%, skim, soy), fresh fruit (11: apples, peaches, nectarines, strawberries, grape, bananas, oranges, cantaloupe, honey dew melon, water melon, pears), vegetables (14: celery, spinach, sweet bell peppers, cucumbers, cherry tomatoes, snap peas, potatoes, hot peppers, carrots, broccoli, lettuce, corn, cabbage, cauliflower), ground beef (3; 20% fat content, 10% fat content , 7% fat content), baby foods (3; fruit, vegetable, meat), peanut butter (1; plain), fruit juice (2; apple & grape), and eggs (1; large) (Appendix B). Altogether, the instrument had a total of 8 food categories or 40 unique food items with the list being used for both conventional and organic items for a total of 80 food items.

The grocery store assessment began with general store characteristics such as verification of the grocery store name and address, and date and time of assessment. Food assessment included product variability and price for variability and price of each food item. Each food item was recorded as though the grocery store has it in stock during the survey. Prices will be recorded in dollars per unit for non- produce and by the pound for produce items. The least expensive approved brand or store brand listed on the WIC Authorized Food List, when available, was selected first. This study did not include measuring of shelf space for milk or quality of the produce, per the NEMS-S protocol, as this study did not focused on the availability or quality of food items, just the variability. The numbers of variations of each food item (organic and conventional) were collected with the lowest and highest price for each. For produce, only the fruits and vegetables listed in the food basket were recorded for each food item, both organic and conventional option. For example, NEMS-S suggests surveying Red Delicious apples for the apple food item. The price for both the organic and conventional Red Delicious apples were recorded. If Red Delicious apples are not available another apple, with an equivalent price point will be selected.

Data collection

Following the NEMS-S instrument protocol, it was not necessary to notify the grocery store personnel when conducting the survey. However, it was my intent to notify the manager upon entering the store, and explain the research project and request permission to collect survey data. The store management was be assured that the store name will not be identified and will only be identified by a store ID number.

Before entering a grocery store, several items on the survey were completed prior such as store ID and date (see Appendix A). Store ID numbers were recorded using the following format: 00-0-00-000. NEMS-S has a specific protocol for assigning store IDs and coded in alphabetical order to reduce confusion for stores of the same name. As previously noted, this study was focused on large grocery chain stores, some were from the same chains, and were therefore assigned in a consecutive order as they assigned in the WIC Authorized Vendor List.

Some aspects of the survey were either not used or were modified to more closely align with the research questions being explored in this research project. According to the survey milk, fruit, vegetables, ground beef, hot dogs, frozen dinners, baked goods, beverages, bread, baked chips, and cereal are included. There are food categories that were excluded from the survey or modified. Food categories that have been excluded do not have organic food items that have been demonstrated in the literature to reduce the risk of pesticide exposure. These excluded food categories include frozen dinners, baked goods, hot dogs, and baked chips. Additional food categories have been included to either more closely align with the WIC Authorized Food List Shopping Guide such as baby food, eggs, and peanut butter. The additional included categories also have the potential to reduce exposure to antibiotic resistant bacteria (eggs and beef) and pesticides (baby food, peanut butter, and fruit juice).

Food items were assessed in the following order: milk, fruits, vegetables, beef, baby food, peanut butter, fruit juices, and eggs. The preferred healthier item and comparable organic item of the same brand were selected first. If both items are not available in the same brand, then the healthier food item will be selected to be as comparable as the organic option as possible. A comment was added to the survey when this occurred along with the brand of both organic and conventional food item surveyed. Variability for each food items was determined by the variety of each food item in the store. The variety of each food item was recorded and quantified. This process was repeated for all food items on the list. If a food item is not stocked, it was noted in the comment section.

The food item price was surveyed for each item and recorded. The highest and lowest price was also collected for the varieties of each food item for both organic and conventional products. If the price was not available, a store employee was asked the price of the item. Based on the NEMS protocol, sales prices are not used unless it is the only price posted. This is to provide comparability between stores and to reduce price elasticity (Glanz et al., 2007).

The NEMS-S instrument has a rating system for the variables variability and price. Each variable has a point range, with a total of 40 points available for both of the combined variables. The variability of healthy food was determined using the NEMS-S healthy food availability scoring, but modified for variability. The NEMS-S instrument used for this study has eight categories. The scoring was from 0 to 24 with the variability defined as follows: For milk (1) 0 varieties = 0 pts, (2) 1-2 varieties = 1 pt, (3) 3-4 varieties = 2 pts, and (4) 5 varieties = 3 pts and will apply to both conventional and organic food categories. For all remaining food categories (1) 0 varieties = 0 pts, (2) 1-5 varieties = 1 pt, (3) 5-9 varieties = 2 pts, and (4) 10+ varieties = 3 pts and will apply to both conventional and organic food categories. The scoring to pricing will be as follows: (1) Lower for organic (conventional/ organic) = 2 pts, (2) Same for both = 1 pt, and (3) Higher for organic = -1 pt. The scoring for price has a maximum score of 16 points (if all 8 food categories had lower pricing for organic options) and a minimum of -8 points (if all 8 food categories had higher pricing for organic options). Additionally for this study, the variability and pricing were compared based on if the grocery store was located in a high or low socioeconomic census tract. Figure 1 presents the Scoring Systems for NEMS Store Measures- Modified

Item	**Availability**	**Price**
1. Milk	0 varieties = 0pts 1-2 = 1pt 2-3 = 2pt ≥ 5 varieties = 3pts	Lower for organic than conventional = 2 pts, Same for both organic and conventional = 1 pt Higher for organic = -1 If no organic = 0
1b. Milk -Organic	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥ 10 varieties = 3pts	
2. Fresh Fruit	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥ 10 varieties = 3pts	Lower for organic than conventional = 2 pts, Same for both organic and conventional = 1 pt Higher for organic = -1 pt If no organic = 0
2b. Fresh Fruit - Organic	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥ 10 varieties = 3pts	
3. Fresh Vegetables	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥10 varieties = 3pts	Lower for organic than conventional = 2 pts, Same for both organic and conventional = 1 pt Higher for organic = -1pt If no organic = 0
3b. Fresh Vegetables - Organic	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥10 varieties = 3pts	
4. Ground Beef	0 varieties = 0pts Yes lean mean ≤10% fat < 5 varieties ≤10% fat = 1pts 5-9 varieties ≤10% fat = 2pt ≥ 10 varieties ≤10% fat = 3pts	Lower for organic than conventional = 2 pts, Same for both organic and conventional = 1 pt Higher for organic = -1 pt If no organic = 0
4b. Ground Beef - Organic	0 varieties = 0pts Yes lean mean ≤10% fat < 5 varieties ≤10% fat = 1pts 5-9 varieties ≤10% fat = 2pt ≥ 10 varieties ≤10% fat = 3pts	
5. Baby Food	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥10 varieties = 3pts	Lower for organic than conventional = 2 pts,

5b. Baby Food - Organic	0 varieties = 0pts <5 = 1pt 5-9 = 2pt 10 varieties = 3pts	Same for both organic and conventional = 1 pt Higher for organic = -1 pt If no organic = 0
6. Peanut Butter	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥10 varieties = 3pts	Lower for organic than conventional = 2 pts, Same for both organic and conventional = 1 pt Higher for organic = -1pt If no organic = 0
6b. Peanut Butter - Organic	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥10 varieties = 3pts	
7. Fruit Juice	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥10 varieties = 3pts	Lower for organic than conventional = 2 pts, Same for both organic and conventional = 1 pt Higher for organic = -1 pt If no organic = 0
7b. Fruit Juice - Organic	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥10 varieties = 3pts	
8. Eggs	0 varieties = 0pts <5 = 1pt 5-9 = 2pt ≥10 varieties = 3pts	Lower for organic than conventional = 2 pts, Same for both organic and conventional = 1 pt Higher for organic = -1 pt If no organic = 0
8b. Eggs - Organic	0 varieties = 0pts <5 = 1pt 5-9 = 2pt 10 varieties = 3pts	

TOTAL POSSIBLE SCORE: 0 to 24 points (availability) -8points to 16 points (price)

Total Summary Score: Up to 40 points possible (availability +price)

Figure 1. NEMS-S scoring system. Adapted from “Nutrition Environment Measures Survey in Stores (NEMS-S): Development and Evaluation,” by K. Glanz, J.Sallis, B. Saelens, & L. Frank, 2007, *American Journal of Preventive Medicine*, 32(4), p. 288. Copyright 2006 Rollins School of Public Health, Emory University.

Data Analysis

The data collected in this study was cleaned prior to entry into the data set and verified by validating the data point entered and reviewing to ensure all data points were entered and fall into the expected range. In addition, simple frequencies were utilized to check data entered with the store list to ensure all stores were entered and correctly categorized. The statistical analyses were conducted using The Statistical Package for Social Sciences (SPSS) version 21.

For the first Research Question 1, organic food item availability is a combined score based on the subtotals for organic availability for each food category. The socioeconomic status of the geographical regions, or neighborhood, will be with two levels: low socioeconomic and high socioeconomic status with dependent variable is the organic food variability score. The mean organic food availability from a high-income large chain grocery stores were compared to the mean organic food availability from a low-income store using a two independent samples *t* test. A chi-square was used to assess the availability differences between high and low-income. The statistical significance was be assessed with an alpha of 0.05 with a power of 0.80. A Levene's test was used to compare group variances.

For Research Question 2, the socioeconomic status of the geographical regions, or neighborhood, were grouped or categorized with two levels: low socioeconomic and high socioeconomic status and the outcome measure is the price point for both organic and non-organic food items. The mean price points for both organic and non-organic food items in high-income large chain grocery store compared with mean price points for both organic and non-organic food items of a low-income store using a two independent samples *t* test. A chi-square was used to assess the variability differences between high and low-income. The statistical significance was assessed with an alpha of 0.05 with a Power of 0.80. A Levene's test was used to compare group variances.

For Research Question 3, organic food item variability is a combined score based on the subtotals for variability and price. The socioeconomic status of the geographical regions, or neighborhood, is the group with two levels: low socioeconomic and high socioeconomic status and the outcome measure is the mean variability of organic food items. The mean organic food variability from a high-income large chain grocery store were compared to the mean organic food variability score from a low-income store using a two independent samples *t* test. A chi-square was used to assess the variability differences between high and low-income. The statistical significance was assessed with an alpha of 0.05 with a Power of 0.80. A Levene's test was used to compare group variances.

To provide additional insight into the overarching question of this study, a one-way ANOVA was conducted to investigate pricing differences between the grocery chains by evaluating how chain prices each food item of both organic and conventional products. The sample is food basket items group included two levels: organic and non-organic. The outcome measure is the large chain grocery store. The statistical significance was assessed with an alpha of 0.05 with a Power of 0.80.

Lastly, the predicted data analyses plan was constructed with the assumption that the data results will have a normative curve distribution. In the event the data does not fit the normative curve, nonparametric tests were applied. The Wilcoxon-Mann-Whitney test was used instead of two independent samples *t* test and a non-parametric chi-square will be used instead.

Analytical Strategies

The independent variables or outcome variables for this study will be (a) organic priced food basket items (items randomly chosen) as provided by the California WIC Food List and under approved criteria (CDPH, 2015), (b) non-organic priced food basket items as provided by the California WIC Food List (CDPH, 2014), and (c) geographical location of store. The dependent variables or samples will be (a) regular pricing of food basket items from surveyed grocery store, (b) variability of organic food basket items from surveyed grocery store, (c) variability of non -organic food basket items from surveyed grocery store, and (d) total cost of food basket cost at all grocery stores surveyed.

A two independent samples *t* test was used to test the mean of high-income to low-income. A chi-square was used to assess the variability differences between high and low-income. A Levene’s test was used to compare group variances. A one-way repeated-measure ANOVA was conducted to evaluate for a difference in pricing of food categories between organic and conventional food items and of organic food categories between stores located in high-income areas and low-income areas.

The validity of measurement is related to reliability, and is interrelated when discussing this concept (Frankfort-Nachmias & Nachmias, 2008). Threats of internal validity were addressed by using Los Angeles County limits boundaries as the geographical region being used. It offered a large sample size and included an appropriate sample size of large chain grocery stores and the food basket items. Additionally, the study occurred in a natural setting and included local, culture, and economic influences that may have influenced availability and cost of various items within the selected geographical location. Possible internal validity threats, selection is of greatest concern. The study looked for specific food items variations available that meet the criteria and were included in the study.

Threats to Validity

The validity of measurement is related to reliability, and is interrelated when discussing this concept (Frankfort-Nachmias & Nachmias, 2008). The NEMS tool was evaluated for inter-rater reliability and test-retest reliability in grocery stores of varying income levels and community configuration (Glanz et al., 2007). The NEMS-S instrument was found to have a high degree of both inter-rater reliability (kappa of 0.84-1.00) and test-retest reliability (kappa of 0.73-1.00) across all food categories surveyed (Glanz et al., 2007).

I was the surveyor for this study and completed the NEMS online training modules including how to modify and customize the survey and survey protocols prior to the data collection phase of the study. By obtaining a certification of completion of the NEMS online training, I have demonstrated my competency of the instrument and will be able to minimize threats to internal validity.

An additional threat to internal validity is the geographical locations of the stores to be surveyed and the study collection timeframe of four weeks. To address this limitation, only stores that are within the boundaries of Los Angeles County were included in the study and surveyed. In addition, the selected geographical area offers a large sample size that will include an appropriate sample size of randomly selected large chain grocery stores. The timeframe of the study does provide the possibility for a change of prices and availability for food items. To address this limitation, the shortest time needed to successfully collect data from all 54 stores was selected. This study occurred in a natural setting and included local, culture, and economic influences that may have influenced availability and cost of various items. Any influences these variations may have were shared across the study population sample. Lastly, the finding of this study may not be generalized to large chain grocery stores beyond the boundaries of Los Angeles County. This limitation was minimized by including large chain grocery stores that have a state wide and national presence. This provided the most complete picture of the nutrition food environment within the large chain grocery stores surveyed.

Ethical Procedure

Whereas this study did not include any human participants, ethical concerns still exist. The name of neither the grocery store nor its address was included in this study and was only identified with a store ID number. The permission of the store manager was solicited upon entering the store and prior to beginning the survey. I outlined the nature of the survey and what information I was collecting. If the manager did not consent to the survey, I would have thanked the manager and exited the store.

Data collected from this study was housed in a locked designated filing cabinet in my home office to ensure the integrity and privacy of the data. Upon completion and approval of this research project by Walden University, the data will be shared with the University of Pennsylvania NEMS staff, by request, and published. However, no information identifying the stores names or locations will be included.

Summary and Transition

I surveyed 54 large chain grocery stores with 27 located in high-income areas and 27 located in low-income areas throughout the county of Los Angeles. High-income areas were defined as census tracts whose mean income level is greater than or equal to 400% of Federal poverty level (FPL) or greater than or equal to $95,400 per annum and low-income areas were defined as census tract whose mean income level of less than 185% of the FPL or less than or equal to $44,123 per annum. The NEMS-S instrument was used to survey the stores and collect data on eight food categories, or a total of 40 food items for both organic and conventional options. The results of the study were analyzed using a two-tailed independent samples *t* test and a chi-square. The results of the study are discussed in Chapter 4

Chapter 4: Results

Introduction

The purpose of this study was to compare organic food availability in large chain grocery stores with locations in both high- and low-income areas in Los Angeles County. I used The NEMS-S instrument to make comparisons between healthy organic and conventional food availability, variability, and prices among stores. I performed data analysis using SPSS v21. This chapter includes the results of the statistical analysis for each research question along with descriptive statistics and a summary.

Data Collection

I conducted the study over the month of September 2015 at 54 stores located throughout Los Angeles County, California. Of the 54 stores surveyed, 27 were located in high-income census tracts and 27 were located in low-income census tracts. I drove a total of 1,320 miles across Los Angeles County to survey the stores. The median household income for the stores located in the low-income census tracts was $34,054.00, compared to $109,323.00, for high-income census tracts as defined in Table 1.

Upon entering each store, I spoke to the store manager or supervisor, explained the research study and requested permission to complete the survey. All 54 stores granted me permission to survey their store. I offered the site letter to each, but only one accepted it.

The general product placement was similar in each store: produce and vegetables were located in the same area near the front of the store and beef, eggs, and milk were located on the sides or back of the store. Baby food, peanut butter, and fruit juices were all located in the middle of the store but the location of the aisle and what they were stocked next to varied. As data collection progressed, I was more familiar with store variations that made the overall survey process easier and decreased the amount of time needed to survey each store. In addition, several of the stores I surveyed did not offer organic food options that also decreased the survey time. It took from 17-61 minutes to survey each store with an average time of 30 minutes.

The number of registers varied from four to 23 depending on the size of the store with a mean number of 8.5 for both income levels. Stores with a highest number of registers, 23 and 16, were distributed evenly between low- and high-income areas. Stores with the lowest number of registers, four, were located in lower income areas. I noted that stores in lower-income areas were generally smaller compared to those located in high-income areas. Additionally, stores located in highly-populated urban areas were generally smaller than those located in less-populated areas.

The NEMS-S instrument required some substitutions and additions to the food items surveyed because of the lack of availability of a couple of items. The NEMS-S instrument listed for survey organic and conventional ground beef with 7%, 10%, and 20% fat content. Upon entering the first store, I noted that only the 15% fat content organic ground beef option was available, so I added 15% fat content organic and conventional ground beef options. I made another substitution for conventional and organic milk. The survey preferred the store brand, but the store brand was not always available for the gallon and half gallon size. To address this, I used the store brand option that provided pricing for both gallon and half-gallon sizes. In addition, the store brand of organic milk was typically only offered at the half-gallon size. To address this, I used an alternate brand for the gallon size. The NEMS-S instrument included peaches but did not specify the type of peach to be included. I made two modifications for fruit. Peaches were offered in either yellow or white varieties, rarely both. There was a $0.50 to $1.00 price-per-pound difference between the two varieties. As such, I recorded both the white and yellow varieties of peaches. Pears were offered in Bartlett or Anjou varieties. Anjou Pears were the preferred pear variety listed on the NEMS-S instrument, but during the survey process, I observed that Bartlett pears were the most commonly available pear and that the Anjou variety had limited availability. Both pear varieties, the Bartlett and Anjou, were recorded.

I used descriptive and frequency statistics to ensure all of the data was inputted correctly, and I assessed the data sample for each research question for normality. To assess the normality of the data, I performed a Shapiro-Wilk’s test, a review of the skewness and kurtosis measures and standard error, and a visual inspection of the histograms, normal Q-Q plots and box plots. I found that the data were normally distributed.

Deviations from Analytical Strategies

For research question two, samples sizes did not meet minimum criteria to conduct an ANOVA by food category or by income level. Selection of individual food items was made based on sample size and the category they represented. Sample sizes did not meet minimum requirements for low-income areas and I was thus unable to complete the ANOVA. I used an independent *t* test in substitution for an ANOVA and conducted it by food item between high- and low-income samples.

For the overarching research question, sample sizes for organic food items did not meet minimum criteria to conduct an ANOVA by food category or by large grocery chain. I instead selected individual food items to represent each food category based on sample size. These items were identical to those used in Research Question 2. The overall large grocery chain sample did not meet minimum requirements for completing an ANOVA. I presented the mean price point for each food category and the total food basket price for the large chains that carried at least one food item from each organic food category.

Hypothesis Testing and Analysis

Research Question 1

To determine whether large chain grocery stores located in high-income census tracts had the same healthy organic food availability as large chain grocery stores in low-income census tracts, I surveyed 27 stores located in high-income neighborhoods and 27 stores located in low-income neighborhoods using the NEMS-S survey instrument. The organic food availability score was a combined score of the availability of each of the eight food categories. The total possible points for the organic availability score was 24. I entered the surveys into a spreadsheet formatted for the NEMS-S instrument, calculated the scores, and then imported them to SPSS for analysis.

The organic food availability for stores located in low- and high-income areas ranged from 0 to 13. The lowest scores of 0 were located in low-income census tracts and the highest scores of 13 were located in high-income census tracts (see Table 1).

Table 1

Organic Food Availability Scores (OFAS) by Neighborhood Income Levels

		Organic Food Availability Scores														
Census Tracts		0	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Neighborhood Income Level	Low	2	2	4	4	3	2	5	1	0	1	1	2	0	2	27
	High	0	0	0	2	0	0	0	1	2	0	4	5	11	2	27
Total		2	2	4	6	3	2	5	2	2	1	5	7	11	2	54

I conducted a one-sample chi-square test to assess whether organic availability varies based on income level (high or low). The results of this test are significant, x^2 (1, *N*= 54) = 25.33, *p* =.021 and the sample proportions are dissimilar to each other. I also conducted an independent *t* test to compare healthy organic food availability in high- and low-income census tracts stores (see Tables 2 & 3). There was a significant difference in the healthy organic food availability for high-income and low-income stores. On average, consumers experienced decreased organic food availability in low-income neighborhoods (*M*= 4.52, *SD* = 3.12) compared to high-income neighborhoods (*M*= 10.44, *SD* = 2.61). This difference is significant *t*(52)= -7.577, *p*<.001 and represented a large effect size *r*=.72 (*r*>.50). Consumers have a higher chance of finding organic food items in high-income stores. Based on the results, the healthy organic food availability of high- and low-income stores were significantly difference and the null hypothesis can be rejected.

Table 2

Descriptive Statistics for Organic Food Availability Scores

Census Tract Income Level	Number of Stores	Mean	Standard Deviation
Low	27	4.52	3.118
High	27	10.44	2.607

Table 3

T test Analysis for Organic Food Availability Scores

Independent Samples Test								
		Levene's Test for Equality of Variances		t test for Equality of Means				
		F	Sig	T	df	Sig.(2-tailed)	Mean Difference	Std. Difference
Organic Food Availability Score	Equal variances assumed	1.769	.189	-7.577	52	.000	-5.926	.782

Research Question 2

To determine whether large chain grocery stores located in high-income census tracts had the same mean prices for both organic and conventional food items in large chain grocery stores in low-income census tracts, I conducted a one-sample chi-square test and an independent *t* test. It was noted during the survey process that not all stores surveyed offered organic items. For stores that did offer organic options, there was a large variance in what food categories, and even specific food items, were available. To better identify which organic items were available, a review was done of the data to identify food items, in each food category that was most widely offered. For organic milk, the half-gallon option was most available with highest availability for whole and skim milk options, whole milk was chosen. For organic fruit, apples were most commonly available and therefore chosen. For organic vegetables, celery was the most common option available. For organic ground beef, only 10% fat content or 15% fat content options were available. While 10% fat content ground beef is the healthiest option, there was only a couple of stores which offered it so 15% fat content ground beef was selected as it was more broadly available. For organic baby food, vegetables were chosen as it was more available than fruit or meat. Organic peanut butter was more commonly available and when recorded creamy was the most available option. For organic fruit juice, only a few stores offered grape juice but all stores surveyed that had organic fruit juice had organic apple juice. Lastly, organic eggs were also generally available at all stores surveyed. To provide a more clear comparison between organic and conventional food availability and pricing, the same items were matched.

The Organic and Conventional Food Availability and Mean Pricing by Income Levels, as shown in Table 3, details the mean organic and conventional price for the above selected food items by neighborhood income level. Milk and eggs were the two food items most commonly available in both low and high-income areas. Organic whole milk half-gallon was available in all, but two, of the stores surveyed and eggs available in 19 low-income and 26 high-income stores. Whereas organic fruit (n=4), vegetables (n=2), and baby food- vegetables (n=6) were least available in low-income areas. A comparison of the conventional version of each organic food items was included to provide a matched pair, as shown in Table 3.

Each of the food items chosen had higher pricing for the organic food item versus the conventional food item. Comparing prices, as shown in Table 4, by organic versus conventional, some of the food items had slight pricing differences as with Apple juice (O = $2.57; C = $2.16) with a price difference of $0.41 in low-income to (O = $4.54; C=$2.99) to a price difference of $1.55 in high-income areas.

Pricing between organic and conventional food categories varied with some items priced one income level lower than the other was. This phenomenon was seen across the food items surveyed. For example prices ranged in price variance from 16%, for organic apple juice and 231% for organic celery in low-income areas to 21% for organic celery and 38% for organic apple juice in high-income areas. There was also a variance observed of organic food item pricing between food items between neighborhood income levels. For example, organic apple juice mean price was $1.97 less expensive in low-income areas whereas 15% fat content ground beef was $2.14 more expensive in higher income areas.

The differences between the availability of organic food items between neighborhood income levels were unexpected. In addition, pricing variation between both organic and conventional food items by income level was also unexpected. As such, I am unable to follow the statistical plan for this question and a change was needed. After completing the frequencies for the Organic and Conventional Food Availability and Mean Pricing by Income Levels (see Table 4), a new statistical plan was identified which would allow me to provide additional insight on this phenomena. To explore the significance of any differences observed, a chi-square and an independent *t* test will be performed on the above food items.

Table 4

Food Availability and Mean Pricing by Neighborhood Income Levels

		Low-income Mean Price	Low-income No. of Stores	High-income Mean Price	High Income No. of Stores
Whole Milk	Organic	$4.95	27	$4.90	25
½ Gallon	Conventional	$2.32	27	$2.47	27
Apples	Organic	$2.49	4	$2.58	21
	Conventional	$0.92	26	$1.69	26
Celery	Organic	$2.29	2	$2.15	24
	Conventional	$1.01	26	$1.71	27
Ground Beef	Organic	$6.99	9	$9.13	21
15% Fat	Conventional	$4.98	17	$6.04	11
Baby Food	Organic	$1.16	6	$1.19	23
Veg.	Conventional	$0.64	27	0.70	25
Peanut	Organic	$4.30	10	$5.82	22
Butter	Conventional	$2.65	27	$2.99	27
Apple	Organic	$2.57	12	$4.54	23
Juice	Conventional	$2.16	27	$2.82	27
Eggs	Organic	$4.80	19	$5.32	26
	Conventional	$3.88	27	$4.47	27

A one-sample chi-square test was conducted to assess whether whole milk half-gallon pricing has an associated to income level (high or low). The results of this test are significant for the organic option, x^2 (9) = 22.540, p =.007 and the conventional option, x^2 (12) = 22.051, p =.037, the sample proportions are dissimilar to each other. An independent *t* test was conducted to compare whole milk half-gallon means prices in high and low-income census tracts stores, as shown in Tables 5 and 6. There was a significant difference in the whole milk half gallon organic item for high-income and low-income stores. A Levene's test was significant for the organic, *p*=.024 and equal variances are not assumed. A Levene's test was not significant for the conventional option, *p*=.234 and equal variances are assumed. On average, consumers experienced lower prices for organic whole-milk half-gallon in high-income neighborhoods (*M*= \$4.89, *SD* = \$0.32) than low-income neighborhoods (*M*= \$4.95, *SD* = \$0.42). However, this difference is non-significant *t*(49)= .518, *p*=.607. Based on the results, the healthy organic food availability scores of high and low-income stores were not significantly difference and the null hypothesis cannot be rejected for organic whole milk half-gallon. Conversely, consumers experienced higher prices for conventional whole-milk half-gallon in high-income neighborhoods (*M*= \$2.47, *SD* = \$0.33) than low-income neighborhoods (*M*= \$2.31, *SD* = \$0.30). However, this difference is non-significant *t*(52)= .-1.867, *p*=.067. Based on the results, neither organic nor conventional whole milk half gallon prices of high and low-income stores were not significantly difference and the null hypothesis cannot be rejected for whole milk half- gallon.

A one-sample chi-square test was conducted to assess whether apple pricing, has an associated to income level (high or low). The results of this test are not-significant for the organic option, x^2 (5) = 6.895, $p > .05$ and the sample proportions are similar to each other. The results are significant for the conventional option, x^2 (12) = 36.451, $p < .001$ and the sample proportions are dissimilar. An independent *t* test was conducted to compare apples means prices in high and low-income census tracts stores, as shown in Tables 5 &6. There was a significant difference in the apples for high-income and low-income stores. A Levene's test was not significant for organic, p=.126, or conventional p=.652, and equal variances are assumed. On average, consumers experienced higher prices for organic apples in high-income neighborhoods (M= \$2.48, SD = \$0.40) than low-income neighborhoods (M= \$2.49, SD = \$0.58). However, this difference is non-significant $t(23)$= 1.335, p=.741. Consumers also experienced higher prices for conventional apples in high-income neighborhoods (M= \$1.68, SD = \$0.38) than low-income neighborhoods (M= \$0.92, SD = \$0.05). However, this difference is significant $t(50)$= -6.395, p <.001. Based on the results, the organic apples means prices of high and low-income stores were not significantly different and the null hypothesis cannot be rejected while the conventional apples mean price of high and low-income stores is significantly difference and the null hypothesis can be rejected.

A one-sample chi-square test was conducted to assess whether celery pricing, has an associated to income level (high or low). The results of this test are not-significant, x^2 (2) = .963, p > .05 and the sample proportions are similar to each other. The results of this test are significant, x^2 (7) = 34.022, p < .001 and the sample proportions are similar to each other. An independent t test was conducted to compare celery means prices in high and low-income census tracts stores, as shown in Tables 5 & 6. There was a significant difference in the celery organic item for high-income and low-income stores. A Levene's test was not significant, p=.217 and equal variances are assumed. On average, consumers experienced higher prices for organic celery in high-income neighborhoods (M= \$2.29, SD = \$0.00) than low-income neighborhoods (*M*= \$2.15, *SD* = \$0.00). However, this difference is non-significant $t(24)= .695$, $p=.493$. Consumers also experienced higher prices for conventional celery in high-income neighborhoods (*M*= \$1.72, *SD* = \$0.32) than low-income neighborhoods (*M*= \$1.01, *SD* = \$0.36). However, this difference is significant $t(51)= -7.526$, $p <.001$. Based on the results, the organic celery means prices of high and low-income stores were not significantly difference and the null hypothesis cannot be rejected while the conventional celery mean price of high and low-income stores is significantly difference and the null hypothesis can be rejected.

A one-sample chi-square test was conducted to assess whether the pricing of 15% fat content ground beef is varied based on income level (high or low). The results of this test are not significant for the organic option, x^2 (4) = .963, $p > .05$ and dissimilar sample proportions while the conventional option x^2 (7) = 34.0522, $p < .001$ is signification and the sample proportions are similar to each other. An independent *t* test was conducted to compare 15% fat content ground beef means prices in high and low-income census tracts stores, as shown in Tables 4. There was a significant difference in the 15% fat content ground beef for high-income and low-income stores. A Levene's test was not significant for organic, $p=.217$, or conventional, $p=487$, and equal variances are assumed. On average, consumers experienced higher prices for organic 15% fat content ground beef in high-income neighborhoods (*M*= \$9.13, *SD* = \$2.10) than low-income neighborhoods (*M*= \$6.99, *SD* = \$0.79). This difference is significant $t(28)= -2.95$, $p<.05$. Consumers experienced higher prices for conventional 15% fat content ground beef in high-income neighborhoods (*M*= 6.17, *SD* = $1.25) than low-income neighborhoods (*M*= $5.01, *SD* = $0.82). This difference is significant $t(21)= -1.66$, $p<.05$. Based on the results, 15% fat content ground beef prices for both organic and conventional option of high and low-income stores were significantly difference and the null hypothesis can be rejected.

A one-sample chi-square test was conducted to assess whether pricing of baby food- vegetables, is varied based on income level (high or low). The results of this test are not- significant, x^2 (5) = .963, $p > .05$ and the sample proportions are similar to each other while the conventional option x^2 (10) = 25.844, $p < .05$ is signification and the sample proportions are dissimilar to each other. An independent *t* test was conducted to compare baby food- vegetables means prices in high and low-income census tracts stores, as shown in Tables 5 & 6. There was not a significant difference in the baby food vegetables for high-income and low-income stores. A Levene's test was not significant for organic, p=.607, and equal variances are assumed and were significant for conventional, $p< .05$ and equal variances were not assumed. On average, consumers experienced higher prices for organic baby food vegetables in high-income neighborhoods (*M*= $1.18, *SD* = $0.24) than low-income neighborhoods (*M*= $1.10, *SD* = $0.09). This difference is not significant $t(27)= -.818$, p=.421. Consumers experienced higher prices for conventional baby food vegetables in high-income neighborhoods (*M*= $1.38, *SD* = $0.25) than low-income neighborhoods (*M*= $1.28, *SD* = $0.17). This difference is not significant $t(41.7)= -1.634$, p=.11. Based on the results, the baby food vegetable prices, both organic and conventional options in high and low-income stores were not significantly different and the null hypothesis cannot be rejected.

A one-sample chi-square test was conducted to assess whether pricing of peanut butter, is varied based on income level (high or low). There was not a significant difference in the peanut butter for high-income and low-income stores. The results of this test are not- significant for the organic option, x^2 (8) = .963, $p >$ .05, or the conventional option, x^2 (11) = 13.018, $p > .05$ and the sample proportions are similar to each other. An independent *t* test was conducted to compare peanut butter means prices in high and low-income census tracts stores, as shown in Tables 4. There was a significant difference in the peanut butter for high-income and low-income stores. A Levene's test was not significant for organic, p=.532, or conventional, p=363, options and equal variances are assumed. On average, consumers experienced higher prices for organic peanut butter in high-income neighborhoods (*M*= $5.82, *SD* = $0.75) than low-income neighborhoods (*M*= $4.30, *SD* = $0.98). This difference is significant $t(30)= -4.839$, $p<.001$. Consumers experienced higher prices for conventional peanut butter in high-income neighborhoods (*M*= $2.99, *SD* = $0.53) than low-income neighborhoods (*M*= $4.30, *SD* = $0.98). This difference is significant $t(52)= -2.669$, $p<.05$. Based on the results, organic and conventional peanut butter prices of high and low-income stores were significantly different and the null hypothesis can be rejected.

A one-sample chi-square test was conducted to assess whether pricing of apple juice is varied based on income level (high or low). The results of this test are significant for the organic option, x^2 (6) = 23.841, p < .001 and the conventional option, x^2 (11) = 32.310, p < .001, the sample proportions are dissimilar to each other. An independent *t* test was conducted to compare apple juice means prices in high and low-income census tracts stores, as shown in Table 4. There was a significant difference in apple juice for high-income and low-income stores. A Levene's test was not significant for organic, p=.990, or conventional, p=.642, and equal variances are assumed. On average, consumers experienced higher prices for organic apple juice in high-income neighborhoods (*M*= $4.54, *SD* = $0.52) than low-income neighborhoods (*M*= $3.57, *SD* = $0.69). This difference is significant $t(33)$= -4.689, p<.001. Consumers experienced higher prices for conventional apple juice in high-income neighborhoods (*M*= $2.82, *SD* = $0.43) than low-income neighborhoods (*M*= $2.16, *SD* = $0.39). This difference is significant $t(52)$= -6.951, p<.001. Based on the results, the apple juice prices for both organic and conventional options from high and low-income stores were significantly different and the null hypothesis can be rejected.

A one-sample chi-square test was conducted to assess whether pricing of eggs is varied based on income level (high or low). The results of this test are significant for organic options, x^2 (44) = -2.436, p = .019, and conventional options, x^2 (8) = -37.848, p < .001 and the sample proportions are dissimilar to each other. An independent *t* test was conducted to compare eggs means prices in high and low-income census tracts stores, as shown in Tables 5 & 6. There was a significant difference in the eggs pricing for high-income and low-income stores. A Levene's test was not significant for the organic option (*p*=.990), and equal variances are assumed but was significant for the conventional option (*p*<.05), and equal variances are not assumed. On average, consumers experienced higher prices for organic eggs in high-income neighborhoods (*M*= $5.33, *SD* = $0.75) than low-income neighborhoods (*M*= $4.80, *SD* = $0.67). This difference is significant *t*(33)= -4.689, *p*<.001. Consumers also experienced higher prices for conventional eggs in high-income neighborhoods (*M*= $4.47, *SD* = $0.39) than low-income neighborhoods (*M*= $3.88, *SD* = $0.21). This difference is significant *t*(40.57)= -6.951, *p*<.001. Based on the results, the organic and conventional eggs prices of high and low-income stores were significantly different and the null hypothesis can be rejected.

Table 5

T test Analysis for Organic Food Item Prices by Neighborhood Income Level

			Independent Samples Test						
			Levene's Test for Equality of Variances		t test for Equality of Means				
			F	Sig.	T	df	Sig.(2-tailed)	Mean Diff.	Std. Error Diff.
Whole Milk Half-Gallon	Organic food price	Equal variances not assumed	5.466	.024	-7.577	42.27	.613	-.05	.10
Apples	Organic food price	Equal variances assumed	2.515	.126	-.335	23	.741	-.08	.24
Celery	Organic food price	Equal variances assumed	1.610	.217	.695	24	.493	.14	.20
Ground Beef 15% Fat	Organic food price	Equal variances assumed	1.220	.279	-2.950	28	.006	-2.14	.73
Baby Food-Veg	Organic food price	Equal variances assumed	.271	.607	-.818	27	.421	-.81	.10
Peanut Butter	Organic food price	Equal variances assumed	.399	.532	-4.839	30	.000	-1.52	.31
Apple Juice	Organic food price	Equal variances assumed	.000	.990	-4.689	33	.000	-.97	.21
Eggs	Organic food price	Equal variances assumed	1.359	.250	-2.436	44	.019	-.53	.22

Table 6

T test Analysis for Conventional Food Item Prices by Neighborhood Income Level

			Independent Samples Test						
			Levene's Test for Equality of Variances		t test for Equality of Means				
			F	Sig	T	df	Sig.(2-tailed)	Mean Diff.	Std. Error Diff.
Whole Milk Half-Gallon	Conventional food price	Equal variances assumed	1.451	.234	-1.867	52	.067	-.16	.09
Apples	Conventional food price	Equal variances assumed	.206	.652	-6.395	50	.000	-.77	.12
Celery	Conventional food price	Equal variances assumed	2.067	.157	-7.526	51	.000	-.71	.09
Ground Beef 15% Fat	Conventional food price	Equal variances assumed	.501	.487	-2.685	21	.014	-1.15	.43
Baby Food-Vegetables	Conventional food price	Equal variances not assumed	7.991	.007	-1.634	41.7	.110	-.10	.06
Peanut Butter	Conventional food price	Equal variances assumed	.841	.363	-2.669	52	.010	-.34	.13
Apple Juice	Conventional food price	Equal variances assumed	.218	.642	-5.889	52	.000	-.59	.08
Eggs	Conventional food price	Equal variances not assumed	7.991	.007	-1.634	41.77	.110	-.10	.06

In summary, there was a significant difference in organic item pricing for four of the food items tested: (a) 15% fat content ground beef, (b) peanut butter, (c) apple juice, and (d) eggs. The null hypothesis can be rejected for these four food items only. There was a significant difference in conventional pricing for five of the items tested: (a) apples, (b) 15% fat content ground beef, (c) peanut butter, (d) apple juice, and (e) eggs. The null hypothesis can be rejected for these five food items only. Reviewing pricing differences for both organic and conventional food items between areas of high and low-income areas, there were only significant differences in 15% fat content ground beef, peanut butter, apple juice, and eggs. Due to the variation between organic food availability between high and low-income areas, statistics were limited to specific food items and generalizations cannot be made for organic food pricing by food category.

Research Question 3

To determine whether large chain grocery stores located in high-income census tracts had the same organic food variability score as large chain grocery stores in low-income census tracts, scores were calculated using the NEMS-S survey instrument. The organic variability score was a combined score based on the subtotals for variability and price for each of the eight food categories. The total possible points for the organic variability score was 40. The surveys were entered in to a spreadsheet formatted for the NEMS-S instrument, the scores calculated, and then imported to SPSS for analysis.

Organic variability scores for stores located in low and high-income areas. The scores range from 17 to 33; lowest score of 17 was located in low-income census tracts and highest scores of 33 was located in high-income census tracts (see Table 7).

Table 7

Organic Food Variability Scores (OFVS) by Neighborhood Income Levels

Count		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Total
Income Level	Low	2	3	2	2	4	2	4	1	1	2	1	0	3	0	0	0	0	27
	High	0	0	2	0	0	0	0	1	0	2	1	0	3	3	6	6	3	27
Total		2	3	4	2	4	2	4	2	1	2	2	0	6	3	6	6	3	54

The mean score for low-income census tracts was 22.26 and 29.44 for high-income census tracts, as shown in Table 8.

Table 8

Descriptive Statistics for Organic Food Availability Scores

Census Tract Income Level	Number of Stores	Mean	Standard Deviation
Low	27	22.26	3.654
High	27	29.44	3.776

An independent *t* test was conducted to compare healthy organic food variability score in high and low-income census tracts stores, as shown in Table 9. There was a significant difference in the healthy organic food availability scores for high-income and low-income stores. On average, consumers experienced decreased organic food variability scores in low-income neighborhoods (M= 22.26, SD = 3.654) than high-income neighborhoods (M= 29.44, SD = 3.776). This difference is significant $t(52)= -7.105$, $p<.00$ and represented a large effect size $r=.70$ ($r>.50$). Consumers generally experienced higher organic food variability at high-income stores than low-income stores. Based on the results, the healthy organic food variability scores of high and low-income stores were significantly difference and the null hypothesis can be rejected.

Table 9

T test Analysis for Organic Food Variability Scores

Independent Samples Test								
		Levene's Test for Equality of Variances		t test for Equality of Means				
		F	Sig	T	df	Sig.(2-tailed)	Mean Difference	Std. Difference
Organic Food Availability Score	Equal variances assumed	.115	.736	-7.105	52	.000	-7.185	1.011

Research Question Overarching

To provide additional insight into the overarching question of this study, a one-way ANOVA was conducted to investigate pricing differences between the grocery chains by evaluating how chain prices organic and conventional food items. However, due to the lack of variability of organic food items in the large grocery stores surveyed, criteria for an ANOVA were not met. To explore this research question with the available data, descriptive statistics and mean pricing were described. Of the 18 large chain grocery stores surveyed, there was variability of organic food items available from zero surveyed organic food items available to 28 of the 40 total organic food items surveyed, as shown in Table 10.

Table 10

Organic Food Variability (OFV) by Grocery Store Chains

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Milk	5	2	0	4	4	4	4	2	5	5	4	4	4	2	4	2	5	4	3.6
Fruit	3	0	0	0	4	3	0	0	3	3	0	3	0	0	0	0	3	0	2.7
Vegetables	8	0	0	2	8	8	0	0	9	9	2	5	0	0	0	0	8	3	3.3
Ground Beef	1	0	0	1	1	0	1	0	1	1	1	0	0	0	0	0	1	0	0.4
Baby Food	3	0	0	1	2	2	1	0	0	3	2	1	3	0	0	0	0	2	1.0
Peanut Butter	2	0	0	1	4	1	0	0	2	2	0	1	0	0	0	2	0	2	0.3
Apple Juice	1	0	0	1	1	2	1	0	0	2	1	1	1	0	0	0	0	1	0.6
Eggs	2	0	0	2	3	1	1	0	0	3	3	1	1	1	1	2	0	4	1.5
Total	25	2	0	12	27	21	8	2	20	28	13	16	9	3	5	6	17	16	13

As demonstrated in Research Questions 1-3, organic food items are generally more expensive than conventional food items. In addition, there is variability of both organic and conventional food items located between areas of high and low-income. Of the 18 large chain grocery stores surveyed, only five contained an organic food items in each of the food category. As discussed in Research Question 2, the food items selected were whole milk half-gallon, apples, celery, 15% fat content ground beef, baby food, vegetables, peanut butter, apple juice, and eggs. To provide a comparison between prices of organic and conventional food items, the above list was used for the five grocery chains that contained food items from all eight food categories. There was one modification for conventional ground beef, 20% fat content was substituted for 15% fat as only three of the stores had that item available.

As shown in Table 11, the mean income for the grocery chains with all of the listed food items is all over $100,000 and located in high-income tracts. The pricing for both organic and conventional foods varied depending on the grocery store. Generally, organic food items were priced higher than conventional. However, Grocery Chain 2 had the same price for both organic and conventional apples and celery. To address pricing differences between grocery chains, the price for each of the selected food items were listed along with a total price for the entire food basket. The total price for the food basket varies from $21.62 to $29.42 for conventional options and $31.87 to $43.27 for the organic options, as shown in Table 11. Overall, each organic food basket cost more than the conventional food basket. For both the organic and conventional food basket, there was pricing variability. These overarching findings support the results from Research Questions 1-3.

Table 11

Organic and Conventional Food Availability, and Mean Pricing by Grocery Chain

Mean Income per Chain		Grocery Chain 1 $105,637	Grocery Chain 2 $148,178	Grocery Chain 3 $115,367	Grocery Chain 4 $106,070	Grocery Chain 5 $117,293
Whole Milk	Organic	$4.49	$5.09	$4.49	$4.99	$4.49
½ Gallon	Conventional	$2.49	$3.49	$2.19	$2.49	$2.19
Apples	Organic	$2.79	$1.99	$1.99	$2.87	$2.37
	Conventional	$1.49	$1.99	$1.49	$1.99	$1.49
Celery	Organic	$2.29	$2.29	$1.99	$2.29	$1.99
	Conventional	$1.79	$2.29	$1.29	$1.79	$1.79
Ground Beef	Organic	$8.99	$14.99	$7.24	$8.99	$7.99
15% Fat	Conventional	$4.00	$7.49	$4.74	$5.64	$4.24
Baby Food	Organic	$0.99	$1.84	$1.19	$1.13	$1.19
Vegetables	Conventional	$1.99	$1.49	$1.69	$1.23	$1.69
Peanut	Organic	$4.99	$6.84	$4.99	$5.99	$4.99
Butter	Conventional	$3.79	$4.44	$2.79	$2.98	$2.84
Apple	Organic	$4.49	$3.99	$3.99	$4.99	$3.99
Juice	Conventional	$2.99	$3.49	$2.99	$2.92	$2.59
Eggs	Organic	$5.99	$6.24	$5.99	$4.63	$5.99
	Conventional	$4.79	$4.74	$4.79	$4.29	$4.79
Total Cost	Organic	$35.02	$43.27	$31.87	$35.88	$33.00
	Conventional	$23.33	$29.42	$21.97	$23.33	$21.62

Summary and Transition

This chapter provided the results for the statistical analyses for the research questions and hypotheses posed in this study. The study sought to compare organic and conventional food options by high and low-income neighborhoods. For the first research question, the null hypothesis was rejected as there was a significant difference $t(52) = -7.577$, $p < .001$ and represented a large effect size $r = .72$ ($r > .50$) between the healthy organic food availability scores of high and low-income stores.

For the second research question, food items were used as surrogates for food categories due to the lack of availability of organic food options in low-income areas. Organic item pricing was statistically significant only for four of the food items tested: (a) 15% fat content ground beef, (b) peanut butter, (c) apple juice, and (d) eggs. The null hypothesis was rejected for these four food items only. There was a significant difference in conventional pricing for five of the items tested: (a) apples, (b) 15% fat content ground beef, (c) peanut butter, (d) apple juice, and (e) eggs. The null hypothesis was rejected for these four food items only. Pricing differences for both organic and conventional food items between areas of high and low-income, were only significant differences in 15% fat content ground beef, peanut butter, apple juice, and eggs and the null hypothesis can be rejected for these four items for both organic and conventional options. However, the research question as a whole is not fully supported as not all of the food items were significantly different.

For the third research question, there was a significant difference in the healthy organic food availability scores for high-income and low-income stores. On average, consumers experienced decreased organic food variability in low-income neighborhoods than high-income neighborhoods. This difference is significant $t(52) = -7.105$, $p < .00$ and represented a large effect size $r = .70$ ($r > .50$). Based on the results, the healthy organic food variability scores of high and low-income stores were significantly different and the null hypothesis was rejected.

For the overreaching research question comparing pricing differences between grocery chains, the price for each of the selected food items was listed along with the total price for all of the items. The total price for this food basket varies from $21.62 to $29.42 for conventional options and $31.87 to $43.27 for the organic options. Due to the small sample size, an ANOVA could not be performed; therefore, it is not known whether the differences are statistically significant. As such, the null hypothesis was not rejected. Chapter 5 is a discussion of the findings and their implications, and recommendations for areas of future study.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this study was to compare organic food availability and pricing in large chain grocery stores located in high- and low-income census tracts in Los Angeles County, CA in order to better understand the nutritional environment of WIC recipients. I conducted this study to fill a gap in the literature regarding organic food availability and pricing for individuals of different socioeconomic levels. The state of California has the largest portion of WIC participants in the country, at 17% (Johnson et al., 2013). Los Angeles County accounts for one-third of all WIC recipients in California and served approximately 67% of all infants, and about half of all children ages 1-5 in 2014 (PHFE WIC, 2015). I surveyed a total of 54 stores, 27 in high-income census tracts and 27 in low-income census tracts--for food availability, variability, and pricing using the NEMS-S instrument. The theoretical frameworks for this study, the SPDPEH and the community nutrition environment, provided a conceptual model for exploring the obstacles inhibiting individuals from living healthy lives. The model of the community nutrition environment provided the framework to investigate the consumer’s experience regarding availability, variability, and price of food items that guided the data collection portion of this study. I explored environmental variables including availability, variability, and pricing of healthy organic and conventional food items.

Interpretation of Findings

An important strength of this study is the modifications I made to the NEMS-S instrument to include data collection of organic options of healthy foods. Additionally, my use of random sampling to obtain the list of stores to be surveyed provided a more comprehensive picture of the availability, variability, and pricing of organic and conventional food items across Los Angeles County. This study differs from others on the topic by looking specifically at healthy organic food items across large chain grocery stores that service WIC recipients. Previous studies have explored and reported on the higher cost of organic items, but few have quantified the differences in prices, and no known study has looked at the WIC food basket and organic food options specifically. The random sampling of all large chain grocery stores that serviced WIC recipients eliminated confounding variables and provided the means to make broader generalizations regarding the nutritional environment as a whole. It was assumed that the large chain grocery stores surveyed would be relatively equal in size, purchasing practices, product selection, and pricing. Surveying multiple large grocery chains from both high- and low-income neighborhoods also provided a clearer picture of the overall nutritional environment for WIC recipients who reside in low- and high-income areas.

The organic food availability score was a combined score of availability of each of the eight food categories in all large chain grocery stores surveyed and compared the findings by income level. The total possible points for the organic availability score was 24. The organic food availability for stores located in low- and high-income areas ranged from 0 to 13. The lowest scores of 0 were located in low-income census tracts and the highest scores of 13 were located in high-income census tracts. There was a significant difference in the healthy organic food availability for high-income and low-income stores. On average, consumers experienced decreased organic food availability in low-income neighborhoods. Consumers have a higher chance of finding organic food items in stores located in high-income areas. These results add to the literature concerning whether having a large chain grocery store located in a low-income neighborhood improved the nutrition environment. I found that having a large chain grocery store in a low-income area does significantly change the nutritional environment for organic food availability.

I used the organic availability score to explore the availability variable of the study. My data analyses of the organic availability score for each store showed there are significant differences in organic food availability between large chains grocery stores located in high- and low-income areas. The finding supports similar findings on the topic that not all consumers have equal access to organic food items and that socioeconomic status may be associated (Curl et al., 2013). I found that the stores located in high-income census tracts had availability scores for organic foods that were statistically significantly higher than those stores located in low-income census tracts.

The mean prices for both organic and conventional food items in large chain grocery stores in low-income census tracts was another aspect of the nutritional environment that I explored. Due to the lack of organic food availability in low-income neighborhoods, I used one food item from each food category as a surrogate. I chose each food item surrogate after a review of the data to identify the food item in each food category that was most widely offered. For organic milk, the half-gallon option was most available, with the highest availability for whole and skim milk options. I chose whole milk as the surrogate. For organic fruit, apples were most commonly available and therefore chosen. For organic vegetables, celery was the most common option available. For organic ground beef, only 10% fat content or 15% fat content fat options were available. There were only a couple of stores where the healthiest option, 10% fat content, was available so I selected 15% fat content ground beef because it provided a more robust sample size. For organic baby food, I chose vegetables because they were more available than fruit or meat varieties. Organic peanut butter was generally available with creamy as the most available option. For organic fruit juice, only a few stores surveyed offered organic grape juice. However, all of the stores surveyed where organic fruit juice was stocked had organic apple juice. Lastly, organic eggs were also generally available at all stores surveyed. To provide a clearer comparison between organic and conventional food availability and pricing, I matched the selected organic food items with their conventional counterpart.

Generally, organic milk and eggs were found in both high- and low-income areas. However, not all stores had full-gallon organic milk available, and some stores did not stock 1% organic milk. The remaining food categories also showed a wide range of availability between stores located in high- and low-income areas. Only two of the low-income stores carried organic apples, and only four of the stores carried organic celery. Organic jalapenos and corn were not available in any of the stores surveyed. Organic ground beef was generally only available as a 15% fat content option, and was limited to nine low-income stores. The availability of organic baby food was also limited, with no organic meat available at low-income stores and organic vegetables available at six low-income stores. Organic apple juice was available in 10 of the low-income stores, while organic grape juice was not available at any of the low-income stores. Lastly, organic peanut butter was available at 12 of the low-income stores and generally only the creamy option.

In regards to pricing of organic food items, I performed a chi-square and an independent *t* test on a food item from each food category for both organic and conventional items. I found a significant difference in organic item pricing for only four of the food items tested: 15% fat content ground beef, peanut butter, apple juice, and eggs. While these findings cannot be generalized to represent the entire food category, they do support similar findings of generally higher cost for organic food items relative to conventional items (Drewnowski, 2012; Drewnowski et al., 2013; Zhang et al., 2013).

I found that the organic option of a food item had an increased price over its conventional counterpart and the amount of variance differed based on income area. The variation in pricing ranged from 16%, for organic apple juice and 231% for organic celery in low-income areas to 21% for organic celery and 38% for organic apple juice in high-income areas. These findings support similar findings from a study by Forman et al. (2012) that showed the average cost increase of 10%-40% for organic items over similar conventional food items. My findings add to those of

Forman et al. by providing delineation between stores located in low- and high-income areas.

Conventional food items in each category were generally less available in lower income stores and included snap peas, nectarines, 10% fat content ground beef, and 20% fat content ground beef. These findings support a previous study that low-income areas have significantly lower availability of healthy foods (Franco et al. 2008). When evaluating pricing, only the conventional options of the organic food items selected were used in order to provide a matched list of food items. For conventional food item pricing, there was a significant difference for five of the items tested apples, 15% fat content ground beef, peanut butter, apple juice, and eggs between high and low-income areas with items significantly less expensive in lower income areas. These findings counter findings of a previous study where organic food items were more expensive in low-income areas (Cassady et al., 2007). It is important to note that food items were analyzed and not the food category as a whole. Finally, upon reviewing pricing differences for both organic and conventional food items between areas of high- and low-income areas, there were significant differences in 15% fat content ground beef, peanut butter, apple juice, and eggs with these prices being less expensive in lower income areas.

To expand upon these findings, the organic food variability score was analyzed to determine whether large chain grocery stores located in high-income census tracts had the same organic food variability score as large chain grocery stores in low-income census tracts. The organic variability score was a combined score based on the subtotals for variability and price for each of the eight food categories. The total possible points for the organic variability score was 40. Organic availability scores for stores located in low and high-income areas. The scores range from 17 to 33; lowest score of 17 was located in low-income census tracts and highest scores of 33 was located in high-income census tracts. The mean score for low-income census tracts was 22.26 and 29.44 for high-income census tracts and represented a significant difference in the healthy organic food availability scores between high-income and low-income stores. On average, consumers experienced decreased organic food variability in low-income neighborhoods than high-income neighborhoods.

Each organic food category has variations in the variety of items available. For example, most low-income stores only had one brand of organic milk available while high-income stores may have two to three brands of organic milk. In regards to produces, organic items in general only had one option. In a few of the high-income stores, there may be two varieties of organic apples, peaches, pears, and potatoes. Generally, there was only one variety of organic apple and grape juice available. There were greater varieties and brands of organic peanut butter available in higher income stores. Organic ground beef was only available in the 15% fat content variety with typically one option available. Organic baby food was generally only available in higher income areas with one to three varieties of fruit or vegetables available. Only five stores, all located in high-income areas, had organic baby food meat options, and of those only two varieties were available. Organic eggs offered the most variability, but only in high-income areas, with upwards of five varieties available.

To provide an overarching look at this study, pricing of both organic and conventional items were explored based on grocery chains. Due to the lack of variability of organic food items in the large grocery stores surveyed, a criterion for an ANOVA was not met; pricing differences between grocery chains were not evaluated. To explore this research questions with the available data, descriptive statistics and mean pricing was reviewed. Of the 18 large chain grocery stores surveyed, there was variability of organic food items available from zero surveyed organic food items available to 28 of the 40 total organic food items surveyed. In addition, only five grocery chains contained all of the food items analyzed in research question two. To provide a food basket, the food items used in research question two were matched with their conventional options to create an organic and conventional food basket with the same food items. These two food baskets were then compared against each other for pricing of each item and to the food basket as a whole. It is important to know that the five grocery chains had a mean income of over $100,000 and were all located in high-income tracts. The pricing for both organic and conventional foods varied depending on the grocery store. Generally, organic food items were priced higher than conventional. The total price for the food basket varies from $21.62 to $29.42 for conventional options and $31.87 to $43.27 for the organic options. Overall, each organic food basket cost more than the conventional food basket. Within each food basket, there was food item price variability between chains. The statistical significance of these findings were not able to be calculated, but did provide additional insight into the prices schemes between grocery chains which carry both organic and conventional food items. It also supports the variability of pricing for both organic and conventional food items, at least in high-income grocery chains.

As noted in Chapter 2, having large chain grocery stores in low-income areas do increase the availability of healthy conventional foods. This study supports the concept because healthy food items were available in low-income areas in nearly the same frequency as high-income. However, this study investigated large chain grocery stores to determine if healthy organic food items in low-income areas were as available when compared to higher income areas. After reviewing the data, it is noted that large grocery chains do not make organic food items available equally in both low and higher income areas. Of the 18 large chain grocery stores surveyed, nine are located in primarily low-income areas and nine in primarily high-income areas. For large grocery chains primarily located in low-income areas only four had more than two categories of organic food items available. Conversely, six of the large chain grocery stores located in high-income areas had two are more food categories of organic food items available.

In the end, significant differences were found in organic item availability and variability between areas of low-income and high-income. With large chain grocery stores located in high-income census tracts having greater availability and variability of organic foods. In addition, there were significant price differences found for specific organic and conventional food items between areas of low- and high-income. For example, organic 15% fat ground beef ranged from $6.99 in low-income to $9.13 in high-income areas. Whereas, conventional 15% fat ground beef ranged from $4.98 in low-income to $6.04 in high-income areas.

Lastly, differences were identified between large grocery chains on pricing of organic and conventional between areas of high-income. Although not all large chain grocery stores located in low-income neighborhoods had organic food items, organic food items were available in low-income areas. The knowledge that healthy organic foods are available in low-income areas is an important step in providing access to all WIC recipients. However, the variance in organic food availability does highlight the need for additional efforts to ensure all WIC recipient have access to organic food items, with multiple varieties, regardless of the income level. Equal access is needed in order to reduce exposure to organophosphates, and antibiotic resistant organisms to pregnant women, infants, and small children.

Limitations of the Study

A limitation of the study would be the overall lack of availability and variability of organic food items in the surveyed stores. This limited the overall sample size and required modifications of the analytic plan and the types of analysis that were performed. In addition, the survey instrument used did not provide the option to record the variability of produce but only the recording of “yes” or “no” if the item was available. The instrument was only able to record if the item is available in the store, but does not allow the option to record how many varieties of each item. By adding the number of varieties of each produce item, it would provide a clearer picture how many varieties of each item were available between organic and conventional variability items.

Statistical power may also have been another limitation of this study as some of the sample sizes analyzed had sample sizes of less than five for items from stores located in low-income areas. This was addressed by analyzing food items as opposed to food categories to provide a larger sample size. However, this change also limited the ability to generalize individual food items to food categories. The power for this study was set at 0.80; however, due to the limitations of organic food availability, modifications were made. For research question one, consumers generally experienced decreased organic food variability scores in low-income neighborhoods and this difference was significant $t(52) = -7.105$, $p < .00$ and represented a large effect size $r = .70$ ($r > .50$). For research question two, minimum samples sizes were unable to be obtained to conduct an ANOVA and the chi-square and independent *t* test were used instead to evaluate a possible statistical significance between organic and conventional food items by income level. For research question three, consumers generally experienced decreased organic food availability in low-income neighborhoods than high-income neighborhoods and the difference was significant $t(52) = -7.577$, $p < .001$ and represented a large effect size $r = .72$ ($r > .50$). Lastly, for the overarching research question, small sample size and an ANOVA could not be completed. In the future, increasing the sample size of the study, in light of the limitations of organic availability, would increase the probability that a difference would be detected and allow power of 0.80 to be used.

The overall scope of the study was limited to the customer nutrition environment as related to the theoretical framework used. The community nutritional environment was used as the conceptual framework, and provided environmental variables to be tested. The type of food outlet, location, and accessibility are aspects of the conceptual framework. The inclusion of income levels to the community nutrition environment allows for a broader picture of the environmental variables at work. In addition, the inclusion of healthy organic food options provides an additional dimension on the nutritional environment and on how consumers define health.

This study was also limited in the number of each grocery chain surveyed. In total 54 stores from high and low-incomes were surveyed or 18 grocery chains. The number of grocery chains surveyed varied from one to nine. This did not provide enough information on each chain to provide a clear picture of the organic availability, variability, and pricing scheme of each chain. This study was also limited to Los Angeles County and the data collected may not be representative of chain stores in other areas. The study was limited by the WIC food basket and the "Dirty Dozen" (highest levels of organophosphates in produce) which determined which food items were surveyed. A final limitation of the study is that it was conducted in early to mid-fall and not all produce items may have been available during data collection.

Recommendations

Some recommendations for future studies would be to conduct additional organic food items availability and pricing studies not only in Los Angeles County, but also in other areas that include a larger sample size of stores and chains in other time frames during the year. Another recommendation would be to survey the same stores during various parts of the year, such as winter, spring, summer, and fall, to provide a more comprehensive representation of food item availability and variability throughout the year. The modifications of the survey instrument to include a focus on healthy organic items can be expanded to add variability of produce and milk options and include quality and shelf space that were removed for this study. It was noted that there did appear to be a difference in the quality of produce and other items, but not a method to collect that data. For example, higher income stores had two separate store brands of milk that varied in price. It was unknown if there was a difference in quality or how the variation in pricing might be measured. Future studies may also find it helpful to conduct a pilot study of the area being surveyed to identify what organic food items are available in various income levels. This would assist in identifying which organic food items, from each food category, are available and determining an appropriate sample size for each. This could provide a clearer picture of organic food availability as a whole, and between high and low-income areas.

A recommendation for data collection would include the ability to customize the electronic survey tool available by the NEMS-S team. This would allow the use of a tablet or IPad to collect data, which would reduce the time, needed to collect and input data into data sets. It would also reduce risk of entering data incorrectly when transcribing from paper to an electronic spreadsheet.

Implications

This study can affect positive social change by adding to the current body of literature on organic food availability and provide insight into the consumer nutrition environment that exists in Los Angeles County. The results of this study can be used to guide purchasing policies of chain stores to provide healthy organic food options for all customers regardless of income level. The results of this study can also be used to provide recommendations on the organic food eligibility for the WIC program.

Ultimately, this study can provide support to expand authorization of organic food items to the WIC authorized food list and increase the produce voucher amount to allow the purchase of more organic produce.

For the grocery store customer, the understanding that some food items contain higher concentrations of organophosphates and antibiotic resistant bacteria can help guide which organic food items to purchase to reduce exposure. In addition, the understanding of which vulnerable populations would benefit from specific food items can further guide food purchasing. This information can shared with consumers through education offered from grocery chains and public health initiatives. More detailed education, including recommendations on organic food items to purchase and what organic items are authorized for purchase through the WIC program, can be provided to WIC recipients.

At a federal level, these findings can be included in the USDA Dietary Guidelines for all Americans to educate which conventional items contain the highest levels of pesticides and provide guidance of which items can be consumed to reduce exposure to pesticides. These findings can also be added to existing educational and initiatives for healthy eating and provide additional tools on how and why organic food items reduce exposure to pesticides and how organic foods could be included in the daily diet. These findings can also be used to provide recommendations at how WIC food items are selected and approved at the federal level. Lastly, these findings can be used to encourage WIC authorized vendors to stock these items so they are available for all WIC recipients regardless of the income level of the store.

Conclusion

Obesity and other diet related diseases are currently a primary topic of public health programs and initiatives (USDA, 2010). The availability, variability, and pricing or conventional food items play a role in preventing these conditions (Glanz et al., 2005). Additional focus is needed on how organic availability, variability, and pricing not only play a role in preventing obesity and related conditions, but also preventing exposure to pesticides and antibiotic resistant organisms to reduce risk for adverse health conditions. Many researchers have explored the food items availability and nutritional environment of conventional food items, but the exploration of organic food availability and the nutritional environment is still emerging. This study introduced the organic food availability, variability, and pricing of stores located in high or low-income areas within Los Angeles County. The findings of this study provide insight on the nutritional environment of a variety of neighborhoods within Los Angeles County, and can be used to further explore the nutrition environment of California or other urban areas. This study also shed some light on the organic availability and pricing of grocery chains, which can be used to provide incentives to WIC, authorized vendors to stock organic food items. Ultimately, this can help influence elasticity so all consumers regardless of socioeconomic status do not have physical barriers to organic foods. Although organic food items are located in large chain grocery stores of low-income neighborhoods, they do not offer the same availability to a range of food categories as large chain grocery stores of higher income neighborhoods. Additional research is needed to provide additional insight to the organic nutrition environment and to address the research questions in this study that were unable to be answered in their entirety. In closing consumers, communities, researchers, and federal programs must work together to provide the education and resources needed to improve the nutrition environment and remove obstacles inhibiting individuals from living healthy lives.

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Appendix A: Nutrition Environment Measures Survey (NEMS) Store Instructions

NUTRITION ENVIRONMENT MEASURES SURVEY (NEMS)
STORE MEASURES

SURVEY INSTRUCTIONS

These measures are designed to rate the nutrition environments of grocery and convenience stores. There are other establishments that may offer food products to purchase that fall into an exclusions category (see below) and may be enumerated but not necessarily rated. However, based on your survey purposes, you may decide to set different exclusion criteria.

Exclusions
Establishments that are not open to the general public, or those where you have to pay a charge just to enter. Establishments that sell a limited variety of food and are not mainly food or convenience stores.
▪ Sam's Club ▪ Costco ▪ Drug stores (CVS, Walgreen's, etc.)

Instructions

The basic principle of these measures is to gather information on comparable items across stores and types of food, so when possible, rate items within the same brand or exactly as specified.

Layout

The majority of the measures have a similar layout.

1. There are "healthier" and "regular" options listed. The healthier option is always listed first.
2. Bold thick lines divide the healthier and regular options.
3. For the measures that have healthier and regular options, the preferred item, which is the item that you would ideally like to rate if it is available, is listed first. The preferred item is followed by alternate items that are in shaded grey boxes.
4. For the milk and frozen dinner measures, there is a section titled "Reference Brand". This refers to the brand name of the food items that will be rated.
5. There is a Measure Complete box at the top right of each page for you to mark when you have completed a measure.

Time

1. Complete grocery store measures between 9 am and 4 pm. (This helps to ensure that items have been stocked for the day and are not sold out.)
2. Complete convenience store measures before 4:30 pm or after 6 pm. (This helps to ensure that you are not in the way during a busy time as these stores are small.)

Availability

1. Before recording any information, first look for the preferred healthier item and the comparable regular item of the same brand.

Measure #1: MILK

Milk Definitions

a. Low-fat milk – skim/fat-free and 1%
b. Reduced fat milk – 2%
c. Whole milk – full fat (3.25%)
d. Soy milk – plain/ original excluded any flavored varieties
e. Organic – labeled as organic

Measurement Procedures

1. Find the milk aisle in the store.

2. Look for the store brand as it is the preferred brand. If **available**, mark "yes".

Store brand (preferred)	○ Yes	○ No

3. If there is no store brand, mark "no" and look for the brand with the most shelf space. If there is equal shelf space for different brands, select the one that has a brand name closest to the beginning of the alphabet (e.g., Foremost instead of Parmalat). Write the name of the brand in the space provided. This brand is now the reference brand for this measure since the store brand was not available.

Alternate Brand Name:	☐☐☐☐☐☐☐☐☐☐☐☐

4. Using the reference brand, look for whole milk, 2% milk, 1% milk, and non-fat (skim) low-fat milk in a conventional option. If **available**, mark "yes".

5. Record the **price** of a gallon and half-gallon of whole milk, 2%, 1%, and non-fat of the reference brand.
   - ❖ If the reference brand does not have milk available in the gallon or half-gallon size, select another brand similar in price and write its name in comments.

6. For the soy milk the reference brand is 8th Continent Soymilk Original for the half-gallon and Pacific Ultra Soy Plain for the quart. Default to these brands if available.

7. If the reference brand does not have soy milk available, select another brand similar in price and write its name in comments.
   - ❖ If the reference brand does not have milk available in the gallon or half-gallon size, select another brand similar in price and write its name in comments.

8. For the organic option section, Repeat steps 2-8.

2. If only one is available, look for the first healthier alternate listed to see if a comparison within the same brand is possible.
3. Once a comparable pair is identified, record the information. You may choose to include recording the information for the one item that is available, in addition to the alternate comparable pair information. If so, write in comments "no comparable pair".
4. If a comparable pair cannot be found, record a healthier and regular item that are as similar as possible.
   - If an item is sold out, write "sold out" in the Comments section and record any available information. Continue down the list until an item is available or the list has been exhausted.

Pricing

1. If price is not available, ask an employee at the cash register or at customer service. Wait until all of the measures have been completed before asking the price of the items that are needed. There may be exceptions to this (i.e., you are in the produce section and there is no price shown but an employee is working there), so use your judgment.
2. Do not use a sale price unless it is the only price posted and write "sale price" in comments.

Preparation

At the top of each page, fill in the following:

- Rater ID
- Store ID
- Type of store: Grocery
- Date

Cover Page

On the cover page, fill in the following:

- Start time (when you enter the store)
- End time (when you have finished the measures and reviewed them for completeness)
- Number of cash registers in the store (including any at the pharmacy or customer service). Each checkout register should be counted, even if a clerk is not there at the time of your visit. For stores that have a self checkout area, include only the cash register(s) serving the self checkout stations.

General Completion Tips

Remember to follow the tips below to decrease the data cleaning time later.

1. Write legibly.
2. Check your work.
3. Use the correct line/bubble.

For Those Whose Forms will be Scanned

The surveys will be scanned on a machine that is very picky, so please remember to do the following:

1. **Darken** your circles once you are sure of the answer.
2. Press down when writing letters or numbers so they are legible and dark.
3. Write your comments and notes on the lines provided.
4. Do not cross through any individual items or sections.
5. Erase any stray marks you make.

Measure #2: FRUIT

Fruit Definitions

a. Conventional – not labeled as organic
b. Organic – labeled as organic

Measurement Procedures

Produce Item		Available Yes	Available No	Price	#	Unit pc	Unit lb	Quality A	Quality UA	Comments
1. Bananas		○	○	$☐.☐☐	☐	○	○	○	○	____________
2. Apples	○ Red delicious ○ ________	○	○	$☐.☐☐	☐	○	○	○	○	____________

1. Find the produce department in the store.

2. Look for the fruit listed. If it is **available**, mark the bubble next to it.

3. If it is not available and there is a line below it for an alternate item, look for the <u>cheapest</u> similar alternate. Write it down and mark the bubble next to it. For example, if there are no Red delicious apples and Gala apples are the cheapest alternate, write "Gala" on the line below "Red delicious".

4. If the fruit or alternate is available, mark "yes". If it is not available, mark "no". If the item is sold out, write "sold out" in comments and record the available information.
   - ❖ If the fruit is only available as pre-sliced and in a container, still mark "yes" for available and write "pre-cut in container" and any size information in comments.
   - ❖ If the fruit is available but mixed with other fruit in a container, mark "no" for available but note the fruit cup contents, price and size in comments.

5. Record the regular **price** of the fruit. If it is on sale and the regular price is not posted, see if it can be calculated based on the sale price label (i.e., add the sales price and the "you save" price) and record it. If the regular price cannot to be calculated based on the sale price label, just record the sale price.
   - ❖ Always choose the pound to price if there is an option.

6. Write the **quantity (#)** of the fruit that is listed **for the price**. For example, if the sign says 2 for $1.00, write "2" for the quantity. If the sign says 3 lbs for 99¢, write "3" for the quantity.
   - ❖ If the fruit is not loose but packaged (e.g., pint or container), count the quantity as "1" and write the quantity of the package in comments.

7. Indicate if the price of the fruit is calculated by the piece or pound by marking "pc" or "lb". For example, if the sign says 2 for $1.00, mark "pc" for piece. If the sign says 3 lbs for 99¢, mark "lb" for pound.
   - ❖ If packaging is other than pc/lb (e.g., per pint or bunch), mark "pc" and note under comments.

Measure #2: FRUIT (cont.)

8. After completing the information for the 11 fruit items, count the number that are marked "yes" under available and record the total.
9. For the organic option section, Repeat steps 2-8.

11. Total Types:	(Count # of yes responses)	☐☐

Measure #3: VEGETABLES

Vegetable Definitions

a. Conventional – not labeled as organic
b. Organic – labeled as organic

Measurement Procedures

Produce Item		Available Yes	Available No	Price	#	Unit pc	Unit lb	Quality A	Quality UA	Comments
1. Carrots	○ 1 lb bag ○ ________	○	○	$☐.☐☐	☐	○	○	○	○	________ ________

1. Find the produce department in the store.

2. Look for the vegetables listed. If it is **available**, mark the bubble next to it.

3. If it is not available and there is a line below it for an alternate item, look for a similar alternate. Write it down and mark the bubble next to it. For example, if there are no 1 lb bags of whole carrots but there are 2 lb bags, write "2 lb bag" on the line below "1 lb bag".
   - For carrots, look for whole carrots. Only select baby or precut carrots as a last resort and make a note in comments.
   - For tomatoes, look for the least expensive loose tomatoes (regular size) first. If not available, look for tomatoes packaged. Choose tomatoes on the vine or cherry tomatoes as a last resort and make a note in comments.

4. If the vegetable or alternate is available, mark "yes". If it is not available, mark "no". If the item is sold out, write "sold out" in comments and record the available information.
   - If the vegetable is only available as pre-sliced and in a container, still mark "yes" for available and write "pre-cut in container" and any size information in comments.
   - If the vegetable is available but mixed with other veggies in a container, mark "no" for available but note the veggie contents, price and size in comments.

5. Record the regular **price** of the vegetable. If it is on sale and the regular price is not posted, see if it can be calculated based on the sale price label (i.e., add the sales price and the "you save" price) and record it. If the regular price cannot to be calculated based on the sale price label, just record the sale price.
   - If the vegetable is not specifically listed as packaged (e.g., corn or celery) but is sold as packaged or loose, record the price of the one that is cheapest.

6. Write the **quantity** (#) of the item that is listed **for the price**. For example, if the sign says 2 for $1.00, write "2" for the quantity. If the sign says 3 lbs for 99¢, write "3" for the quantity.
   - If the item is sold by the package (e.g., corn), count the quantity as "1" and write the number of the item included in the package in comments (e.g., 3 in package).
   - Always choose the pound to price if there is an option.

7. Indicate if the price of the item is by the piece or pound by marking "pc" or "lb". For example, if the sign says 2 for $1.00, mark "pc" for piece. If the sign says 3 lbs for 99¢, mark "lb" for pound.

Measure #3: VEGETABLES (cont.)

- If packaging is other than pc/lb (e.g., per pint or bunch), mark "pc" and note in comments.
- If an item is packaged and its size is listed in pounds or equal to a pound, mark "lb" for pound.

8. After completing the information for the 14 vegetable items, count the number that are marked "yes" under available and record the total.

9. For the organic option section, Repeat steps 2-9.

11. Total Types: (Count # of yes responses) ☐☐

Measure #4: GROUND BEEF

Ground Beef Definitions:

a. Lean ground beef: ≥93% lean, ≤7% fat
b. Lean ground beef: ≥90% lean, ≤10% fat
c. Standard ground beef: 80% lean, 20% fat
d. Organic option: labeled as organic

Measurement Procedures

Item	Available Yes No N/A	Price/lb.	Comments
Healthier option:			
1. Lean ground beef, **93%lean, 7% fat** (Ground Sirloin)	○ ○	$☐.☐☐	________________ ________________

1. Find the fresh meat case in the store. If the store does not sell prepackaged meat, go to the butcher's case to look for ground beef.

2. Identify the brand of ground beef that occupies the most shelf space and for which there are both lean and regular options. Note that lean ground beef may be labeled "ground sirloin", but the label should indicate the % fat.

3. For the healthier option, locate the lean ground beef with 7% fat. If **available**, mark yes. Choose the package of lean ground beef closest to one pound. Record the **price per lb** listed and **not** the actual price of the package of meat (i.e., the label should have a price/lb and price. Record the price/lb.). Mark "N/A" for the alternate items.

4. Then look for lean ground beef with 10% fat. If available, write in the % fat (e.g., 10), mark "yes" and record the price per lb listed. Mark "N/A" for the remaining alternate item.

5. Then look for lean ground beef with 20% fat. If available, write in the % fat (e.g., 20), mark "yes" and record the price per lb listed. Mark "N/A" for the remaining alternate item.

6. Count and record the **number of varieties** of lean ground beef available, which includes both different brands and variety of % fat (e.g., 10%, 7%, 3%, etc.).

# of varieties of lean ground beef (≤10% fat)	○ 0	○ 1-2	○ 3-4	○ 4-5	○ 6-9	○ 10+

7. For the organic option section, Repeat steps 3-6.

Measure #5: BABY FOOD

Baby Food Definitions

a. Fruit (plain fruit) 3.5-4.0oz container (Graduates excluded)
b. Vegetables (plain vegetables) 3.5-4.0oz container (Graduates excluded)
c. Meat (meat with gravy/ broth) 2.5oz (Graduates excluded)
d. Organic option: labeled as organic

Measurement Procedures

Item	Available Yes No N/A	Price/pkg	Comments
1. Fruit	○ ○	$☐.☐☐	________ ________

1. Find baby food in the Baby area in the store.

2. Locate fruit baby food (plain fruit) store brand. If **available**, mark "yes" and record the **price**. Mark "N/A" for the alternate brand/ item.
   - If store brand option is not available, go to the first alternate item (Gerber) and look for 3.5 – 4.0oz size. Plain fruit options should be selected.
   - Count and record the **number of varieties** of plain fruit options available, which includes different brands

# of varieties of plain fruit	○ 0	○ 1-2	○ 3-4	○ 4-5	○ 6-9	○ 10+

3. Locate vegetables baby food (plain vegetables) store brand. If **available**, mark "yes" and record the **price**. Mark "N/A" for the alternate brand/ item.
   - If store brand option is not available, go to the first alternate item (Gerber) and look for 3.5 – 4.0oz size. Plain vegetable options should be selected.
   - Count and record the **number of varieties** of plain vegetables options available, which includes different brands

# of varieties of plain vegetables	○ 0	○ 1-2	○ 3-4	○ 4-5	○ 6-9	○ 10+

4. Locate meat baby food (meats with gravy/ broth) store brand. If **available**, mark "yes" and record the **price**. Mark "N/A" for the alternate brand/ item.
   - If store brand option is not available, go to the first alternate item (Gerber) and look for 2.5oz size. Meat with gravy or broth options should be selected.
   - Count and record the **number of varieties** of meat with gravy/ broth options available, which includes different brands

# of varieties of meats with gravy/ broth	○ 0	○ 1-2	○ 3-4	○ 4-5	○ 6-9	○ 10+

5. For the organic option section, Repeat steps 2-4.

Measure #6: PEANUT BUTTER

Peanut Butter Definitions:

a. Conventional option: plain variety in 16-18oz
b. Organic option: Labeled as organic plain variety in 16-18oz

Measurement Procedures

1. Find the peanut butter in the nut butter section.

2. Look for store brand as the reference brand. If **available**, mark "yes".

3. If not available, mark "no" and choose another brand that has both conventional and organic varieties. Write the name of the brand in the space provided.

Brand Name:	□□□□□□□□□□□□□□□□

4. If not available, choose another brand that has the lowest cost for conventional and the lowest cost for organic. Write the name of the brand in the space provided.

Brand Name:	□□□□□□□□□□□□□□□□

5. Count and record the **number of varieties** of plain peanut butter, which includes different brands

# of varieties of plain peanut butter	○ 0	○ 1-2	○ 3-4	○ 4-5	○ 6-9	○ 10+

6. For the organic option section, Repeat steps 2-5.

Measure #7: FRUIT JUICES

Fruit Juice Definitions

a. Conventional :100% Fruit Juice- Ready to drink 64oz
b. Organic: Labeled as organic 100% Fruit Juice- Ready to drink 64oz

Measurement Procedures

Item	Available Yes No	Price	Comments
Apple Juice: 100% 64oz	○ ○	$☐.☐☐	________

1. Find the bottled ready to drink juice section in the store.

2. Look for store brand as the reference brand and the 100% juice option. **If available**, mark "yes" and record the **price**. If not available, Mark "no" for the alternate items.

3. If not available, mark "no" and choose another brand that has both conventional and organic varieties. Write the name of the brand in the space provided.

Brand Name:	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

4. If not available, choose another brand that has the lowest cost for conventional and the lowest cost for organic. Write the name of the brand in the space provided.

Brand Name:	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

5. Count and record the **number of varieties** of 100% Juice 64oz, which includes different brands

# of varieties of Fruit Juices	○ 0	○ 1-2	○ 3-4	○ 4-5	○ 6-9	○ 10+

6. For the organic option section, Repeat steps 2-5.

Measure # 8-EGGS

Egg Definitions

c. Conventional : one dozen large eggs
d. Organic: Labeled as organic one dozen large eggs

Measurement Procedures

Item	Available Yes No	Price	Comments
Large eggs One Dozen	○ ○	$☐.☐☐	__________

1. Find eggs in the egg section in the store.

2. Look for store brand as the reference brand and for large one dozen. If **available**, mark "yes" and record the **price**. If not available, Mark "no" for the alternate items.

3. If not available, mark "no" and choose another brand that has both conventional and organic varieties. Write the name of the brand in the space provided.

Brand Name:	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

4. If not available, choose another brand that has the lowest cost for conventional and the lowest cost for organic. Write the name of the brand in the space provided.

Brand Name:	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

5. Count and record the **number of varieties** of one dozen large, which includes different brands

# of varieties of one dozen large eggs	○ 0	○ 1-2	○ 3-4	○ 4-5	○ 6-9	○ 10+

6. For the organic option section, Repeat steps 2-5.

Appendix B: Nutrition Environment Measures Survey (NEMS)

Measure Complete

Nutrition Environment Measures Survey (NEMS)
Measure #1: MILK

Rater ID: Store ID:

Date: Month Day Year

O Grocery Store

Marking Instructions
Please use a pencil or blue or black ink Correct ● Incorrect

A. Reference Conventional Brand
1. Store brand (preferred) O yes O no
2. Alternate Brand Name

Comments: ____________________

Reference Organic Brand
1. Store brand (preferred) O yes O no
2. Alternate Brand Name

Comments: ____________________

B. **Conventional Availability** Comments:

1. a. Is whole milk available?	O Yes	O No	________
b. Is low-fat 2% available?	O Yes	O No	________
c. Is low-fat 1% available?	O Yes	O No	________
d. Is non-fat (skim) available?	O Yes	O No	________
e. Is soy milk available?	O Yes	O No	________

Organic Availability

2. a. Is whole milk available?	O Yes	O No	________
b. Is low-fat 2% available?	O Yes	O No	________
c. Is low-fat 1% available?	O Yes	O No	________
d. Is non-fat (skim) available?	O Yes	O No	________
e. Is soy milk available?	O Yes	O No	________

Page 1

Nutrition Environment Measures Survey (NEMS)
Measure #1: MILK - Continued

C. Conventional Pricing: All items should be same brand — Comments:

1. Whole milk, gallon $ ☐ . ☐☐ ____________________
2. Whole milk, half-gal. $ ☐ . ☐☐ ____________________
3. 2% milk, gallon $ ☐ . ☐☐ ____________________
4. 2% milk, half-gal. $ ☐ . ☐☐ ____________________
5. 1% milk, gallon $ ☐ . ☐☐ ____________________
6. 1% milk, half-gal. $ ☐ . ☐☐ ____________________
7. Skim milk, gallon $ ☐ . ☐☐ ____________________
8. Skim milk, half-gal. $ ☐ . ☐☐ ____________________
9. Soy milk, half-gal. $ ☐ . ☐☐ ____________________
9. Soy milk, quart . $ ☐ . ☐☐ ____________________

C. Organic Pricing: All items should be same brand — Comments:

1. Whole milk, gallon $ ☐ . ☐☐ ____________________
2. Whole milk, half-gal. $ ☐ . ☐☐ ____________________
3. 2% milk, gallon $ ☐ . ☐☐ ____________________
4. 2% milk, half-gal. $ ☐ . ☐☐ ____________________
5. 1% milk, gallon $ ☐ . ☐☐ ____________________
6. 1% milk, half-gal. $ ☐ . ☐☐ ____________________
7. Skim milk, gallon $ ☐ . ☐☐ ____________________
8. Skim milk, half-gal. $ ☐ . ☐☐ ____________________
9. Soy milk, half-gal. $ ☐ . ☐☐ ____________________
10. Soy milk, quart $ ☐ . ☐☐ ____________________

Measure Complete

Nutrition Environment Measures Survey (NEMS)
Measure #2: FRUIT

Rater ID: 	Store ID:

Date:
Month Day Year 	O Grocery Store

Availability and Price - Conventional

Produce Item		Available Yes	No	Price	Unit #	pc	lb	Comments
1. Bananas		O	O	$.	☐	O	O	______
2. Apples	O Red delicious	O	O	$.	☐	O	O	______
	O______							______
3. Oranges	O Navel	O	O	$.	☐	O	O	______
	O______							______
4. Grapes	O Red Seedless	O	O	$.	☐	O	O	______
	O______							______
5. Cantaloupe		O	O	$.	☐	O	O	______
6. Peaches		O	O	$.	☐	O	O	______
7. Strawberries		O	O	$.	☐	O	O	______
8. Honeydew Melon		O	O	$.	☐	O	O	______
9. Watermelon	O Seedless	O	O	$.	☐	O	O	______
	O______							______
10. Pears	O Anjou	O	O	$.	☐	O	O	______
	O______							______
11. Nectarines		O	O	$.	☐	O	O	______

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

Nutrition Environment Measures Survey (NEMS)
Measure #2: FRUIT - Continued

Availability and Price - Organic

Produce Item		Available Yes	Available No	Price	Unit #	Unit pc	Unit lb	Comments
1. Bananas		O	O	$ ☐.☐☐	☐	O	O	________ ________
2. Apples	O Red delicious O ________	O	O	$ ☐.☐☐	☐	O	O	________ ________
3. Oranges	O Navel O ________	O	O	$ ☐.☐☐	☐	O	O	________ ________
4. Grapes	O Red Seedless O ________	O	O	$ ☐.☐☐	☐	O	O	________ ________
5. Cantaloupe		O	O	$ ☐.☐☐	☐	O	O	________ ________
6. Peaches		O	O	$ ☐.☐☐	☐	O	O	________ ________
7. Strawberries		O	O	$ ☐.☐☐	☐	O	O	________ ________
8. Honeydew Melon		O	O	$ ☐.☐☐	☐	O	O	________ ________
9. Watermelon	O Seedless O ________	O	O	$ ☐.☐☐	☐	O	O	________ ________
10. Pears	O Anjou O ________	O	O	$ ☐.☐☐	☐	O	O	________ ________
11. Nectarines		O	O	$ ☐.☐☐	☐	O	O	________ ________

12. Total Types: (count # of yes responses) ☐☐

Measure Complete

Nutrition Environment Measures Survey (NEMS)
Measure #3: VEGETABLES

Rater ID: Store ID:

Date: Month Day Year O Grocery Store

Availability and Price – Conventional

Produce Item		Available Yes	Available No	Price	Unit #	Unit pc	Unit lb	Comments
1. Carrots	O 1 lb bag	O	O	$.		O	O	________________
	O ________							________________
2. Cherry tomatoes	O Loose	O	O	$.		O	O	________________
	O ________							________________
3. Sweet Peppers	O Green bell	O	O	$.		O	O	________________
	O ________							________________
4. Broccoli	O Bunch	O	O	$.		O	O	________________
	O ________							________________
5. Lettuce	O Green leaf	O	O	$.		O	O	________________
	O ________							________________
6. Corn		O	O	$.		O	O	________________
								________________
7. Celery		O	O	$.		O	O	________________
								________________
8. Potatoes	O Idaho	O	O	$.		O	O	________________
								________________
9. Snap peas		O	O	$.		O	O	________________
								________________
10. Cauliflower		O	O	$.		O	O	________________
								________________
11. Cucumber		O	O	$.		O	O	________________
								________________

Nutrition Environment Measures Survey (NEMS)
Measure #3: VEGETABLES - Continued

	Yes	No	Price	#	pc	lb	Comments
12. Spinach	O	O	$ ☐.☐☐	☐	O	O	________________ ________________
13. Cabbage	O	O	$ ☐.☐☐	☐	O	O	________________ ________________
14. Hot peppers	O	O	$ ☐.☐☐	☐	O	O	________________ ________________

15. Total Types: (count # of yes responses) ☐☐

Availability and Price – Organic

Produce Item		Available Yes	Available No	Price	Unit #	Unit pc	Unit lb	Comments
1. Carrots	O 1 lb bag O _______	O	O	$ ☐.☐☐	☐	O	O	________________ ________________
2. Cherry tomatoes	O Loose O _______	O	O	$ ☐.☐☐	☐	O	O	________________ ________________
3. Sweet Peppers	O Green bell O _______	O	O	$ ☐.☐☐	☐	O	O	________________ ________________
4. Broccoli	O Bunch O _______	O	O	$ ☐.☐☐	☐	O	O	________________ ________________
5. Lettuce	O Green leaf O _______	O	O	$ ☐.☐☐	☐	O	O	________________ ________________
6. Corn		O	O	$ ☐.☐☐	☐	O	O	________________ ________________
7. Celery		O	O	$ ☐.☐☐	☐	O	O	________________ ________________
8. Potatoes	O Idaho	O	O	$ ☐.☐☐	☐	O	O	________________ ________________

Nutrition Environment Measures Survey (NEMS)
Measure #3: VEGETABLES - Continued

9. Snap peas	O O	$ __ . __ __	☐	O O	________ ________
10. Cauliflower	O O	$ __ . __ __	☐	O O	________ ________
11. Cucumber	O O	$ __ . __ __	☐	O O	________ ________
12. Spinach	O O	$ __ . __ __	☐	O O	________ ________
13. Cabbage	O O	$ __ . __ __	☐	O O	________ ________
14. Hot peppers	O O	$ __ . __ __	☐	O O	________ ________

15. Total Types: (count # of yes responses) ☐☐

Measure Complete ☐

Nutrition Environment Measures Survey (NEMS)
Measure #4: GROUND BEEF

Rater ID: ☐☐ Store ID: ☐☐ - ☐ - ☐☐ - ☐☐☐

Date: ☐☐ ☐☐ ☐☐
Month Day Year

O Grocery Store

Availability and Price - Conventional

Item	Available Yes	No	N/A	Price/lb.	Comments
Healthier Option:					
1. Lean ground beef, **93% lean, 7% fat** (Ground Sirloin)	O	O		$ ☐.☐☐	______
2. Lean ground beef (10% fat)	O	O	O	$ ☐.☐☐	______
3. Ground beef (20% fat)	O	O	O	$ ☐.☐☐	______

4. # of varieties of lean ground beef (≤ 10% fat) O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+

Availability and Price - Organic

Item	Available Yes	No	N/A	Price/lb.	Comments
Healthier Option:					
1. Lean ground beef, **93% lean, 7% fat** (Ground Sirloin)	O	O		$ ☐.☐☐	______
2. Lean ground beef (10% fat)	O	O	O	$ ☐.☐☐	______
3. Ground beef (20% fat)	O	O	O	$ ☐.☐☐	______

4. # of varieties of lean ground beef (≤ 10% fat) O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+

Measure Complete

Nutrition Environment Measures Survey (NEMS)
Measure #5: Baby Food

Rater ID: Store ID:

Date: Month Day Year O Grocery Store

Availability and Price

Item	Available (Yes No N/A)	Price/pkg.	Comments
Conventional Option:			
1. Fruit (Brand name)	O O	$.	
# of varieties of plain fruit		O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+	
2. Vegetables (Brand name)	O O O	$.	
# of varieties of plain vegetables		O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+	
3. Meat (Brand name)	O O O	$.	
# of varieties of meat with gravy/broth		O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+	

Availability and Price - Organic

Item	Available (Yes No N/A)	Price/pkg.	Comments
Conventional Option:			
1. Fruit (Brand name)	O O	$.	
# of varieties of plain fruit		O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+	

Nutrition Environment Measures Survey (NEMS)
Measure #5: Baby Food – Continued

	Yes	No	N/A	Price	
2. Vegetables (Brand name)	O	O	O	$.	________
# of varieties of plain vegetables	O 0	O 1	O 2	O 3	O 4 · O 5 · O 6-9 · O 10+
3. Meat (Brand name)	O	O	O	$.	________
# of varieties of meat with gravy/broth	O 0	O 1	O 2	O 3	O 4 · O 5 · O 6-9 · O 10+

Measure Complete ☐

Nutrition Environment Measures Survey (NEMS)
Measure #6: Peanut Butter

Rater ID: ☐☐

Store ID: ☐☐-☐-☐☐-☐☐☐

Date: ☐☐ ☐☐ ☐☐
Month Day Year

O Grocery Store

Availability and Price

Item	Available Yes No N/A	Price/pkg.	Comments
Conventional Option:			
1. Peanut butter - plain 16-18oz	O O	$ ☐.☐☐	_____
☐☐☐☐☐☐☐☐☐☐☐ Brand name			

# of varieties of plain peanut butter O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+

Availability and Price

Item	Available Yes No N/A	Price/pkg.	Comments
Organic Option:			
1. Peanut butter- plain 16-18oz	O O	$ ☐.☐☐	_____
☐☐☐☐☐☐☐☐☐☐☐ Brand name			

# of varieties of plain peanut butter O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+

Measure Complete

Nutrition Environment Measures Survey (NEMS)
Measure #7-Fruit Juices

Rater ID: Store ID:

Date: Month Day Year O Grocery Store

Availability & Price

Conventional option:	**Available size**	**Available** Yes	No	N/A	**Price**	**Comments**
1. Apple juice -100% (Brand name)	64 oz.	O	O		$	________

# of varieties of 100% Apple Juice O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+

		Yes	No	N/A		
2. Grape juice – 100% (Brand name)	64 oz.	O	O		$	________

# of varieties of 100% Grape Juice O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+

Organic option:	**Available size**	**Available** Yes	No	N/A	**Price**	**Comments**
1. Apple juice -100% (Brand name)	64 oz.	O	O		$	________

# of varieties of 100% Apple Juice O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+

		Yes	No	N/A		
2. Grape juice – 100% (Brand name)	64 oz.	O	O		$	________

# of varieties of 100% Grape Juice O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+

Measure Complete

Nutrition Environment Measures Survey (NEMS)
Measure #8: Eggs

Rater ID: Store ID:

Date: Month Day Year O Grocery Store

Availability & Price

Item	Available	Price	Comments
Conventional option:			
1. One dozen large eggs	O O	$	
Brand name			
# of varieties of dozen large eggs	O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+		
Organic Option:			
1. One dozen large eggs	O O	$	
Brand name			
# of varieties of one dozen large eggs	O 0 O 1 O 2 O 3 O 4 O 5 O 6-9 O 10+		