

EATING HEALTHFULLY ON A LIMITED INCOME: A MULTISYSTEMIC APPROACH
TO THE BARRIERS LOW-INCOME POPULATIONS FACE IN OBTAINING ADEQUATE
NUTRITION IN THE U.S.

by

MARYANN POSTIGLIONE

B.A., California State University Sacramento, 2009

A REPORT

submitted in partial fulfillment of the requirements for the degree

MASTER OF SCIENCE

Department of Human Nutrition
College of Human Ecology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2014

Approved by:

Major Professor
Dr. Mary Meck Higgins

Copyright

MARYANN POSTIGLIONE

SPRING 2014

Abstract

Because of the ever-changing nature of the economy and the food environment, research as recent as 2010 may not be relevant to today's discussion on food insecurity, food deserts, obesity rates, and nutritional quality in the U.S. population's diet. Today, people of low socioeconomic status in the U.S. are at risk for overweight, obesity, and chronic illnesses such as type 2 diabetes, hypertension, and certain cancers. In this report, I investigate published research about low-income populations in the U.S. relative to the food environment and describe implications for healthcare professionals implementing interventions with these populations, discussed in the following categories: *Dietary Intake Quality and Socioeconomic Status; Food Insecurity; Barriers to Quality Food Access in the U.S. Food Environment; Communities Alleviating Food Insecurity; Food-Related Perceptions, Attitudes, and Behaviors; Homelessness and Food-Related Behaviors; Why Do People Buy What They Buy?; Nutrition Assistance Programs and Policies; Current U.S. Food Costs; and Comparing the Nutritional Value Versus Price of Foods*. Although the literature on the subject of low-income diet quality is thorough, much of it needs to be updated with current data on food prices, food environments, and U.S. diet quality. For this purpose, I compiled the most recent data from the National Bureau of Labor & Statistics on food prices to discuss the elevated food prices of healthful foods as opposed to less healthful foods. I also created a one-month menu based on the U.S. Department of Agriculture's Thrifty Food Plan budget allowance in order to follow a healthful diet in this harsh economic climate utilizing the Dietary Guidelines for Americans 2010 and the Affordable Nutrients Index.

Table of Contents

List of Figures.....	v
List of Tables.....	vi
List of Abbreviations.....	vii
Acknowledgements.....	viii
Dedication.....	ix
Methods	1
Discussion of Literature Themes.....	3
Dietary Intake Quality and Socioeconomic Status	3
Fruits and Vegetables.....	3
Vitamin D	4
Excesses.....	4
Food Insecurity	7
Barriers to Quality Food Access in the U.S. Food Environment.....	11
Communities Alleviating Food Insecurity	15
Food-Related Perceptions, Attitudes, and Behaviors	19
Homelessness and Food-Related Behaviors	22
Why Do People Buy What They Buy?	24
Nutrition Assistance Programs and Policies.....	27
Current U.S. Food Costs.....	34
Comparing the Nutritional Value Versus Price of Foods	41
My One-month Thrifty Food Plan/Dietary Guidelines 2010 Menu	44
Personalized Budget and Dietary Guidelines.....	45
Menu	46
Recipes.	52
Shopping Costs	55
USDA Dietary Guidelines Breakdown.....	58
Personal Reflections	63
Gaps in Research.....	67
Conclusion.....	68
References	69

List of Figures

Figure 1: Various Top-Pick Commodity Food Costs from 2004-2014 from the Bureau of Labor & Statistics.....	38
Figure 2: Menu by Week for 3/1/2014-3/31/2014	47

List of Tables

Table 1: FY 2014 SNAP Income Requirements.....	28
Table 2: FY 2014 SNAP Benefits.....	29
Table 3: Official USDA Food Plans: Cost of Food at Home at Four Levels, U.S. Average, June 2013.....	35
Table 4: Additional Monthly Costs by Household Size for More-Healthful Foods.....	37
Table 5: USDA Dietary Guidelines for 1800 kcal Daily Food Plan for Adults Ages 18+.....	45
Table 6: Total Cost of Foods, per Food Groups, for the March 2014 Menu.....	57
Table 7: Menu Analysis by Food Groups and Calories, 3/1/2014 to 3/31/2014.....	59

List of Abbreviations

Affordable Nutrient Index.....	ANI
Body Mass Index.....	BMI
Early Childhood Caries.....	ECC
Greater Chicago Food Depository’s Producemobile	GCFDP
Kilocalories.....	kcal
National Health and Nutrition Examination Survey.....	NHANES
National School Lunch Program.....	NSLP
Nutrient Rich Foods.....	NRF
School Breakfast Program.....	SBP
Socioeconomic Status.....	SES
Special Supplemental Nutrition Program for Women, Infants, and Children.....	WIC
Supplemental Nutrition Assistance Program.....	SNAP
United States Department of Agriculture.....	USDA

Acknowledgements

I would like to thank my advisor, Dr. Mary Meck Higgins, for helping me with this report across time zones.

I also thank my husband, Chris Browne, for encouraging me while I worked on this report.

Dedication

I dedicate this report to those who recognize and alleviate food insecurity within their communities.

Methods

Throughout my time as a graduate student in Kansas State University's Human Nutrition program, the subject of health disparities presented as a consistent concern for public health among populations with low-income status. Poverty is defined yearly, and in 2014 it is having an annual income below or equal to \$11,670 for a one-person household and an additional \$4,060 for each additional family member (Federal Register, 2014). Low income is not a legal term, but is typically defined as having an annual income that is below or equal to 200% of the poverty threshold. Programs for low-income families set varying standards, such as 150% of the poverty level, or \$17,505 for a one-person household and an additional \$6,090 for each additional family member (US Department of Education, 2014). In my attempt to have an in-depth understanding of the nutritional status of all levels of low-income populations in the U.S., I began to research published literature on this subject under two themes: cultural influence and current nutritional status. I hypothesized that cultural views affect low-income populations' food choices in achieving adequate nutrition and need to be considered by health care professionals in order for them to give effective nutrition counseling. I also wanted to focus specifically on what diet-related diseases and health problems this population is at most at-risk for and compare them to this population's food choices. The literature I reviewed revealed that the nutritional status of people with low incomes is much more complex than dietary choices and income barriers.

I made sure that my review of literature was as current as possible and relevant to today's discussion of low-income nutrition status with a majority of my literature published after 2010. I focused my literature search on U.S. populations because of issues that are unique to the U.S. First, I reviewed the *Journal of the Academy for Nutrition and Dietetics* articles from 2012-2013 to gather any information that fell into cultural influence on food choices and diet quality status of low-income populations categories. Next, I expanded my literature search to include supporting articles from the selected articles in the *Journal of the Academy for Nutrition and Dietetics*, utilizing databases from Kansas State University's library. At this point, my findings expanded to a complex and multidimensional focus on the issue of nutrition in low-income populations. Doing a general keyword search of the entirety of the databases Kansas State University has to offer with the *Primo by Ex Libris* database system, I found many articles from reputable journals such as the *American Journal of Public Health*, the *American Journal of*

Preventive Medicine, Preventive Medicine, the American Journal of Clinical Nutrition, and the Journal of Nutrition Education and Behavior. My keywords included “low-income nutrition,” “low-income diet quality,” “low-income consumption of fruits and vegetables,” “diet and nutrition in oral health,” “disparities in the food environment,” “food insecurity,” “food insecurity is positively related with,” and “low-income, food insecurity, nutrition quality.” Upon reading the articles, I discovered that my literature search revealed additional themes to the issue of the nutritional status of people with low incomes, besides cultural influence on food choices and diet quality status of low-income populations. Thus, I have separated my sources into these separate sections in this report: *Dietary Intake Quality and Socioeconomic Status; Food Insecurity; Barriers to Quality Food Access in the U.S. Food Environment; Communities Alleviating Food Insecurity; Food-Related Perceptions, Attitudes, and Behaviors; Homelessness and Food-Related Behaviors; Why Do People Buy What They Buy?; Nutrition Assistance Programs and Policies; Current U.S. Food Costs; and Comparing the Nutritional Value Versus Price of Foods.*

The end of the report focuses on current food costs in the U.S., including charts and graphs that I retrieved from the National Bureau of Labor & Statistics. Using these data coupled with resources focused on nutrition value and food costs, I created a one-month menu based on the U.S. Department of Agriculture’s Thrifty Food Plan budget allowance (USDA, 2013 c.) and the Dietary Guidelines for Americans 2010 (USDA, 2010). In this menu for the month of March 2014, I attempted to stay within budget of the Thrifty Food Plan for the average of 2013 for a family of one person, 26-year-old female, while also following the recommendations of the Dietary Guidelines for Americans 2010 (USDA, 2010) for an 1800 kcal/day diet, and the Affordable Nutrients Index (Drewnowski, 2013). I used the USDA’s *SuperTracker* (USDA, 2014) to analyze the nutritional quality of my menu's recipes and food choices. I put this menu into practice by purchasing these items and cooking and eating only these foods during the month of March 2014 in order to better understand the barriers that low-income populations face in creating a healthful menu and brainstorming how to overcome these barriers. I have divided this section into the following sub-sections: *Personalized Budget and Dietary Guidelines, Menu, Recipes, Shopping Costs, USDA Dietary Guidelines Breakdown, and Personal Reflections.*

Discussion of Literature Themes

Dietary Intake Quality and Socioeconomic Status

According to the United States Department of Agriculture's (USDA's) Healthy Eating Index-2010, adult and child populations of all incomes in the U.S. fall short of meeting dietary guidelines. Although children in the U.S. have increased their intake of total fruit since 2004, they have also increased their empty calories. Likewise, adults have increased their intake of whole fruit since 2001 along with sodium and empty calories. The increase in fruit consumption is promising, but overall the dietary quality does not meet the guidelines, with extremely low scores in the vegetable, whole grain, and seafood categories as well as too much solid fat, added sugars, and sodium (USDA, 2010; USDA, 2013 a.&b.). Because populations of low-income status, compared to those with higher incomes, are less likely to make food choices consistent with the USDA's recommendations, they are an at-risk population for chronic diseases associated with overweight and obesity (Giskes et al., 2007). In this section, I will break down the different dietary concerns for populations of low-income as follows: Fruits and Vegetables, Vitamin D, and Excesses.

Fruits and Vegetables

Fresh fruits and vegetables contain vitamins, minerals, antioxidants, fiber, and phytochemicals, and have been associated with decreased risk of type 2 diabetes, cardiovascular disease, cancer, and obesity (Hendrickson et al., 2006). The Dietary Guidelines for Americans 2010 recommends 2 ½ cups of fruits and vegetables per day because of the associated reduced risk of cardiovascular disease, including heart attack and stroke (USDA, 2010). Regarding at-home spending for food in low-income households, Stewart & Blisard (2006) found that fruits and vegetables were the most under-allocated food group in the budget, compared to the allocation for produce in the Thrifty Food Plan, and that protein purchases were the most-allocated food group in the budget of low-income households. Paradoxically, children from the lowest income population consumed significantly more fruits and vegetables than children from the highest income group according to National Health and Nutrition Examination Survey (NHANES) data from 2003-2004, the most recent data available (Centers for Disease Control & Prevention, 2004). Hiza et al. (2013) attribute these surprising data—that children of low-income households eat enough fruits and fruit juices—to the low-income children's higher participation

rates in the National School Breakfast and Lunch Programs as well as the Summer Food Service Program. On the other hand, low-income adults eat below the minimum recommendations for fruit intake in comparison to other income/socioeconomic status (SES) groups. This is a consistent theme in low-income households that experience financially constrained food access, because the adults compromise their diets to help children in the household (Kirkpatrick et al., 2012). Researchers need to consider how that affects the diets of the adults in these households in future surveys. Also these data are limited, since the information may be outdated because of changes in the food environment for low-income populations between 2008 and 2013. These changes will be discussed in the Food Security and U.S. Food Environment section.

Vitamin D

In the U.S., dietary intakes of vitamin D are below recommended intakes, with 20% of the population having below-adequate vitamin D serum levels (USDA, 2010). Vitamin D is an essential nutrient with several health benefits, including strengthening bone density. Severe vitamin D deficiency results in rickets in children, and osteomalacia in adults. Although the body can produce vitamin D via sunlight exposure to the skin, most of the vitamin D in the U.S. is obtained from fortified foods such as milk, soymilk, and ready-to-eat cereals (USDA, 2010). The USDA recognizes that the lack of dietary vitamin D intake is common, as stated in the Dietary Guidelines 2010. Moore et al. (2013) conducted a study examining children from ages 1-18 years in the U.S. and found that vitamin D intake is greater among higher income populations in comparison to low-income populations. Since decreased vitamin D intake increases the risk of low vitamin D serum status, children from low income families may be at increased risk for lower bone density, rickets, and osteomalacia later in life (Au et al., 2013; Laster et al., 2013).

Excesses

Within the last decade, research has revealed that low income is related to reduced quality of diet, with low SES populations eating too much energy, fat, sodium, and simple sugars (Beydoun & Wang, 2008). Foods high in energy, fat, sodium, and simple sugars are known as calorie-dense foods. Consistently consuming foods with high caloric density increases the total caloric intake of an individual's diet intake, which is a public health concern for this at-risk population. The USDA recommends limiting these foods in order to prevent chronic diseases,

and increasing intake of nutrient-dense foods instead. Nutrient-dense foods are low in solid fats, added sugars, or refined starches, and high in essential nutrients such as vitamins and minerals. Examples of nutrient-dense foods are fresh fruits and vegetables. Populations incorporating many calorie-dense foods in their food plan increase their risk for chronic disease (USDA, 2010).

Attempting to eat from each food group the amounts suggested by the USDA, but choosing typical food choices, Americans will exceed their recommended caloric intake. Although Americans may try to follow the Dietary Guidelines, they typically lack the knowledge to eat foods without many extra calories. According to the NHANES from 2003-04, Americans typically choose foods within each food group that have added calories from solid fats and added sugars (Centers for Disease Control & Prevention, 2004). Eating fruit canned in syrup and eating dark leafy green vegetables prepared with solid fats are examples of typical U.S. food choices. Choices of typical foods—as opposed to nutrient-dense foods—leads to a diet too high in calories, saturated fat, solid fats, added sugars, and sodium. The Dietary Guidelines are intended to meet nutrient needs without exceeding energy requirements, yet the typical American diet falls short of the Dietary Guidelines for Americans and exceeds energy requirements. Thus, nutrition education is needed. When addressing food choices with at-risk populations, public health education efforts should emphasize the need to eat more nutrient-dense foods and to moderate consumption of solid fats and added sugars (Britten et al., 2012).

Regarding dietary intake quality among low-income populations, the literature overwhelmingly points to both excess energy intake and protein intake among low-income populations as being a great public health concern. Obesity rates continue to be of great concern to public health, and socio-economic distress has a positive relationship to increased obesity within low-income populations (Davis et al., 2013). Comparing energy intakes over 20 years of NHANES surveys, low-income populations continue to consume significantly larger amounts of energy than higher income populations, and energy intake has increased among 2-6 year old children, which has increased in the proportion of foods that are key sources for added sugars and fats (Laster et al., 2013). Socioeconomic status is the key predictor of childhood obesity (Davis et al., 2013). As aforementioned, Stewart & Blisard (2006) found that protein purchases were the most-allocated food group in the budget of low-income families. Laster et al. (2013)

found that low-income children consumed far more protein than the recommended 0.95 to 1.0 g protein/kg of body weight, with an average of 3.0 g protein/kg of body weight, but did not report intakes for higher income children. Although studies have shown that low-income children have a higher intake of fruits and vegetables, they also have a higher intake of solid fats than their higher-income counterparts (Hiza et al., 2013). At least some of this solid fats intake come from their excessive intake of animal protein. Excessive intake of meat and energy is positively linked to diet-related diseases such as cardiovascular disease, hypertension, and type 2 diabetes (Ford et al., 2013; Couch et al., 2013; Slining et al., 2013; Davis et al., 2013; Laster et al., 2013; Lu et al., 2013).

Increased added sugars in the diets of low-income children are of special concern because it can lead to severe dental caries in children. Early childhood caries (ECC) is defined as children younger than the age of 6 years having one or more decayed tooth surfaces, or missing teeth, because of caries. Untreated caries can lead to problems with speech, sleeping, and eating and children with them are more likely to suffer from malnourishment, specifically low weight-for-height and iron deficiency anemia. ECC and severe ECC are the result of newly erupted dentition, bacterial plaque, and dietary components. A study by Evans et al. (2013) reported that, currently, 30% of low-income children younger than the age of 6 years have untreated dental decay. These researchers found that children with severe ECC consumed significantly more added sugars from food and beverages when compared with caries-free children. Children who consumed on average >5 oz./day of sugar-sweetened beverages were up to 4.6 times more likely to have severe ECC in comparison to children who consumed <1 oz./day of sugar-sweetened beverages. Low-income children are at high risk of ECC because of their significantly higher intake of added sugars, in comparison to children living in higher-income households (Wang et al., 2010; Laster et al., 2013). ECC is completely preventable and interventions to reduce the intake of added sugars are important for the low-income population (Evans et al., 2013).

Food Insecurity

Populations that experience a high level of food insecurity have an elevated risk of chronic disease and illness because of food insecurity's association with poor diet quality and sporadic eating frequency. The USDA defines food security as having enough food for an active, healthy life at all times (Coleman-Jensen et al., 2013; USDA, 2010). To be food-secure, individuals need to have readily available, nutritionally adequate, and safe foods, and the ability to acquire food in socially acceptable ways. The USDA makes the distinction of socially acceptable ways in order to emphasize that emergency food supplies, scavenging, stealing, and other coping strategies are not characteristic of a food secure household. If someone does not meet the mentioned requirements, he or she is considered food insecure (Coleman-Jensen et al., 2013; USDA, 2010). Food insufficiency is when households fear running out of food in addition to not having a secure source of food (Townsend et al., 2001). Food insecure individuals often find themselves hungry because of a lack of food or recurrent lack of access to food (USDA, 2010). In 2012, 14.5 percent of U.S. households were food insecure at least some time during the 12 month period (Coleman-Jensen et al., 2013).

Adult populations that experience some level of food insecurity are significantly more overweight and obese than food secure populations, a paradox that causes these populations to be more vulnerable to diet-related chronic disease and illness (Dressler & Smith, 2013; Leung et al., 2012; Dammann & Smith, 2009; Dinour et al., 2007; Townsend et al., 2001). Populations that shop in disadvantaged neighborhoods with decreased availability of healthful foods also have increased body mass index (BMI) status, which suggests that the lack of nutrient-dense foods in these neighborhoods contributes to the food insecurity-obesity paradox (Dammann & Smith, 2009; Townsend et al., 2001). Furthermore, the "food stamp" cycle, a monthly cycle in which participants overcompensate energy intake during initial disbursements, may contribute to the unhealthy sporadic eating habits related to overweight and obesity status (Leung et al., 2012; Dinour et al., 2007). I will discuss implications of this cycle in the Nutrition Assistance Programs and Policies section.

The literature is inconsistent regarding whether food insecurity has a positive association with BMI status among children and adolescents and their subsequent risk for chronic illness and

diseases (Couch et al., 2013; Ford et al., 2013; Laster et al., 2013; Larson et al., 2012; Shaudies et al., 2012; Hoerr et al., 2008; Gibson, 2006). Food insecurity may increase the chances of children to be overweight and obese by 3.5 times, or it may decrease the chance of an overweight or obese status by 1.6 times, or there may be no relationship between BMI and food security status (Dinour et al., 2007). The lack of consistency in the literature may be attributed to some parents or caretakers—especially females—protecting children from food insecurity by sacrificing their own nourishment for the children of the household (Dressler & Smith, 2013; Dammann & Smith, 2009; Dinour et al., 2007). This phenomenon may also explain why, among adults who experience some level of food insecurity, women are more likely than men to be overweight or obese, although both had positive associations between food insecurity and increased weight (Leung et al., 2012; Townsend et al., 2001).

Adults in food-insecure and food-insufficient households typically put the nutritional needs of their children before their own, which results in more restricted food availability for these adults (Masters et al., 2012; Kirkpatrick et al., 2012; Dammann & Smith, 2010; Hughes et al., 2010; Nord & Parker, 2010; Wang et al., 2010; Smith et al., 2010; Dammann & Smith, 2009; Beydoun & Wang, 2008; Hoerr et al., 2008; Wiig & Smith, 2008; Richards & Smith, 2007; Townsend et al., 2001). The frequent use of this method to shield children from hunger can lead to adverse health outcomes in the parents. As discussed in the first section of this report, children of low-income status may eat more fruits and vegetables in comparison to the adults in the same households, partly because of parents shielding their youngsters from hunger and nutrient insufficiency. Parents reported that in cases of food insufficiency, their children always ate first because "the child's health takes priority" over that of the adults in the households (Dammann & Smith, 2009). Adult male income earners in these households had a more adequate diet in comparison to the non-income-earning adult females in these households (Richards & Smith, 2007). Although parents are helping to meet the nutritional needs of their children, compensating for their children's nutritional needs without having resources to compensate for their own puts them at greater risk for not meeting the Dietary Guidelines 2010. Health professionals need to consider these adult household members' food behaviors when assessing their dietary needs.

Children who experience food insecurity in the U.S. are more vulnerable to nutrient deficiencies and possibly unhealthy weight status during a critical time of their development (Larson et al., 2012). Surveying parents and caregivers of adolescents using a combination of the U.S. Household Food Security Survey Module, anthropometric testing, and food frequency testing, Poole et al. (2013) and the USDA (2012 a. & b.) found that food insecurity is directly associated with poor eating patterns and increased weight status among adolescents. They found that low vitamin D intake was directly related to food insecurity among adolescent girls, which is of concern because of their need for optimal bone development. Most recently, using the Self-Administered Food Security Survey Module for Children Ages 12 years and Older, Poole et al. (2013) found that food-secure adolescents agreed at a higher rate than food-insecure participants that diet is related to health and that teenagers should be concerned about their eating habits. African-American adolescents in this study reported food insecurity at a higher rate than other populations, indicating that future public health efforts should be directed to meeting the needs of this group. Although evidence is unclear on the role that food insecurity plays on BMI status, healthier food options need to be more readily available to lower-income youth and their families in order to improve the health status of adolescents with food insecurity (Larson et al., 2012).

Implications of food insecurity and food insufficiency on children's health, development, and well-being are tremendous and of great concern to future generations. In a review of literature published between 2000 and 2010, Nord & Parker (2010) found numerous reports of associations between food insecurity and health, both mental and physical. They reported that food insecurity and food insufficiency among children is associated with the following:

- Lower parental attachment in 2-year olds
- Lower mental proficiency in 2-year olds
- Behavioral problems in 3-year olds
- Lower physical function in children ages 3-8
- Lower math achievement and gain in achievement in kindergarteners
- Lower arithmetic scores and higher likelihood of repeating a grade for children ages 6-11
- Worse health of children as reported by parents
- More stomachaches, frequent headaches, and colds
- Iron deficiency anemia in young children

- Higher rates of hospitalization of young children
- More internalizing behavior problems in children
- Worse psychosocial function and psychosocial development in school-age children
- Higher rates of depressive disorder and suicidal symptoms in adolescents

Evidence that food insecurity and food insufficiency negatively affect the well-being, health, and development of children is undeniable, and consequences of the negative outcomes affect future generations. Hunger is impairing children from performing basic functions in school and other social settings. Since ten percent of households with children in the U.S. in 2012 were food-insecure (Coleman-Jensen et al., 2013), interventions are urgently needed to provide adequate and consistent access to quality food in order for these children to healthfully develop physically and mentally.

Barriers to Quality Food Access in the U.S. Food Environment

The food environment includes the home, schools, workplaces, food service and retail establishments, and other community settings (USDA, 2010). Food environments play an important role in a community's food security status. The U.S. food environment constrains low-income individuals living in areas with limited and expensive nutrient-dense foods from practicing healthy eating habits. Socioeconomic constraints on individuals and households can lead to a poor diet quality (Beydoun & Wang, 2008) and living in a socioeconomically disadvantaged area in the U.S. is an independent risk factor for poor diet and low fruit and vegetable consumption (Winkler et al., 2006). Cross-sectional studies reveal that small grocery stores and corner/convenience stores are more common in zip codes with low-income populations, while fully stocked grocery stores are more common in zip codes with higher-income populations (Andreyeva et al., 2010; Song et al., 2009; Wiig & Smith, 2008; Giskes et al., 2007; Jetter & Cassady 2006; Hendrickson et al., 2006). Small grocery stores and corner convenience stores are known for high prices and low variety in nutrient-dense foods. Researchers found that fiber content of foods in small grocery or corner/convenience stores were on average 2 grams of fiber per serving of whole wheat breads, in comparison to large fully stocked grocery stores in higher-income neighborhoods that had an average of >3g of fiber per serving of whole wheat bread. On average, higher-income neighborhoods paid less for their food than did low-income neighborhoods (Lipsky, 2009; Townsend et al., 2009; Hendrickson et al., 2006). When foods of high nutritional value were available in small grocery stores and corner/convenience stores, the price was elevated. For instance, when comparing the fat content of ground meats, the lower the fat content, the higher the price. Small grocery stores in low-income neighborhoods sell staple foods at a higher price than the larger stores in higher-income neighborhoods do, creating a food environment where basic foods are unaffordable to low-income households (Hendrickson et al., 2006). Thus, shopping in their own neighborhoods gives low-income populations a disadvantage in meeting the Dietary Guidelines for Americans 2010.

On a related topic, the healthfulness of foods commonly advertised in neighborhoods varies from one region to another. Supermarket characteristics not only vary based on the neighborhood's income but also according to "obesity-rate" regions, which can further hinder at-risk populations from adopting a healthful diet. Obesity-rate regions were categorized according

to the Centers for Disease Control and Prevention's census of total adult obesity rates (Martin-Biggers et al., 2012). In a one-month cross-sectional study of supermarkets across the U.S., Martin-Biggers et al. (2012) found that foods advertised in different neighborhoods corresponded with that neighborhood's BMI characteristics. Overall, space devoted to advertising protein was the most, at 34%. Fruits and vegetables trailed, with only 12% and 10%, respectively. Supermarkets in regions with <25% obesity-rate had significantly more space devoted to the fruit group and to the yellow-fleshed fruit subgroup than other obesity-rate regions. These researchers also found that >30% obesity-rate regions had significantly more advertisement space in the stores for candy and sugar-sweetened beverages. Low-income populations who have experienced some form of food insecurity rely on sales and advertisements to purchase affordable food for their families, according to Webber et al. (2010). This team found that supermarkets allot significantly more space to protein foods than to fruits and vegetables, and more space to less healthful foods, in high obesity-rate regions versus low obesity-rate regions. Also, as mentioned in a previous section of this report, excessive intake of animal protein contributes to a high intake of unhealthful solid fats. Nutrition professionals should consider the sales shopping environment within their areas of practice as to the appropriateness of recommending using grocery sales as a menu planning strategy.

Responses that consumers report regarding the food environment in which they live in can be attributed to "adaptive reactions" to modern life, as described by Webber et al. (2010). These reactions include pragmatic acceptance of their situation through day-to-day survival within the food environment, and cynical pessimism related to active anxiety provoked by the dangers of modern life. Also, consumers reported optimism while navigating through their food environment and gaining satisfaction from buying food for their families within the existing parameters of the grocery store. However, some respondents in the study had radical engagement to generate change within their shopping environment. The research team described these individuals as "change agents" who "push the 'rules' of social structures, the generalizable procedures and routines that occur in daily living, rules like abiding by set prices displayed by a store, not being a 'bother' by complaining about a product even when it is dangerous, not asking for product information from staff, or buying something simply because it is the cheapest or most convenient option rather than because of its quality, healthfulness, or place of origin or

production method” (Webber et al., 2010). Although populations living within disadvantaged neighborhoods don’t have many opportunities for dietary improvement within their food environments, the change agents living in these areas have an optimistic outlook. Once shoppers do challenge store quality to store owners, managers, and/or employees, they become more self-aware of their shopping experiences, which could lead to positive changes in their personal food-related behaviors (Lohse et al., 2012).

Food deserts play an important role in the health quality of low-income populations living in these areas and significantly affect food choices. Dammann & Smith (2010) define food deserts as “Areas offering few to no consumer food resources, or areas where healthful, affordable food is scarce.” Food deserts vary throughout the U.S. For instance, populations living in an area with no public transportation or access to private transportation for any reason are considered to be living in a food desert. When discussing residents living in a food desert in Clark County, Washington, Sund (2013) writes, “Many at-risk residents in this rural county either don’t have access to transportation or simply can’t afford the gas to drive 15 to 50 miles round-trip to a food bank.” Populations may live very close to a market, but the quality of the fresh fruit and produce is suboptimal (Sund, 2013; Dammann & Smith, 2010; Smith et al., 2010; Hendrickson et al., 2006). When looking at several urban communities in Minnesota, Hendrickson et al. (2006) found that some markets provided poor-quality produce because smaller markets did not have air conditioning or proper refrigeration to keep produce fresh. Also, the aforementioned low-income neighborhoods that have elevated prices compared to higher income neighborhoods are also classified as food deserts (Sund, 2013). Nutrition professionals who work with populations living in a food desert may find that many of their clients want to eat more healthfully but face the barrier of not having access to healthful food options (Sund, 2013; Dammann & Smith, 2010; Smith et al., 2010; Hendrickson et al., 2006). It is not enough to provide education and counseling to at-risk populations if their access to quality diets is restricted.

While food deserts play an important role in shaping the eating habits of low-income populations, the availability of fast-food and full-service restaurants also plays a crucial role in shaping the food environment. The proportion of available fast-food restaurants varies greatly

according to neighborhoods' income characteristics. Studies show that fast-food consumption is associated with obesity, as a result of higher intakes of calories, especially from fat, saturated fat, refined carbohydrates, sugar, and soft drinks (Powell et al., 2007; Winkler et al., 2006). Between 1997-2007, the number of U.S. fast-food restaurants doubled while the number of full-service restaurants remained constant, according to Powell et al. (2007). This team found that although the national food climate encouraged several restaurant chains, including fast-food restaurant chains, to start providing more healthfully prepared options, higher-income neighborhoods currently have more healthful food choices in comparison to low-income neighborhoods. In addition to less healthful options at fast-food restaurants, low-income neighborhoods have significantly more fast-food restaurants than do their higher-income counterparts. Compared to higher income neighborhoods, low-income neighborhoods had 1.24 times more fast food restaurants, and when going from higher income neighborhoods to low-income neighborhoods, the proportion of fast food restaurants increased by 28% (Powell et al., 2007). Coupled with the lack of fully stocked grocery stores and high prices of foods in low-income neighborhoods, the prevalence of fast-food restaurants with less healthful foods elevates the risk of diet-related diseases among low-income populations.

Because of the food environment, food deserts lead to populations settling for less-healthful food options or experiencing food insecurity as a result of the lack of food access within the community (Sund, 2013). The Dietary Guidelines 2010 take into consideration how food insecurity affects populations in the U.S., but do not address food deserts (USDA, 2010). Overwhelmingly, the literature agrees that living in disadvantaged areas contributes to several diet-related ailments, including obesity, type 2 diabetes, cancer, and heart disease, all of which may be prevented or delayed with the addition of fruits and vegetables to the diet (Hendrickson et al., 2006). The lack of healthful, affordable food hinders low-income populations living in a food desert from maintaining a consistent healthful lifestyle (Smith et al., 2010).

Communities Alleviating Food Insecurity

Communities around the U.S. are coming together to address the problem of food deserts and food insecurity directly. Several authors have published calls for interventions designed with extremely low-income populations living in food deserts in mind (Sund, 2013; Dammann & Smith, 2010; Smith et al., 2010; Hendrickson et al., 2006).

Community food pantries provide emergency assistance to families with food insecurity, and the use of these community assistance programs is a prevalent aspect among food insecure households in the U.S. According to the Coleman-Jensen et al. (2013), food pantries and emergency kitchens are the primary providers of emergency food assistance, and 70% of households experiencing any level of food insecurity visited a food pantry within a 12-month period. In a statistical summary of the use of U.S. food pantries and emergency kitchens in 2010, Coleman-Jensen et al. (2013) described the impact of food pantries in the last decade: “Food pantries distribute unprepared foods for offsite use. An estimated 32,737 pantries operated in 2000 (the last year for which nationally representative statistics are available) and distributed, on average, 239 million pounds of food per month. Households using food pantries received an average of 38.2 pounds of food per visit.” Considering the large amount of food distributed, food pantries play a very important role in alleviating food insecurity. Until recently, limited research had been published on the impact of food pantries and emergency kitchens on at-risk populations. This topic has become a popular interest in the field of food insecurity research.

While 70% of the population experiencing food insecurity typically relies on community food pantries/banks for emergency foods at some time during the year, often these emergency programs do not meet the minimum nutrient guidelines for a healthful diet. When looking at two major food pantries in the Milwaukee area over a four-month period, Baumler et al. (2013) found that refined grains were the most prevalent foods distributed. In the vegetables food group, over 30% were starchy vegetables. Overall, the foods distributed were extremely low in dairy and fruit. Examining these findings using the USDA National Nutrient Database, this team found that the foods were low in fiber, calcium, and vitamin C. Similarly, Akobundu et al. (2004) found that vitamins A and C, calcium, fruit, and dairy products were limited in food pantries in Massachusetts. These findings are specific to the Milwaukee and Massachusetts areas, but

provide insight into what may be lacking in other U.S. food pantries. Both studies suggest that efforts to educate donors and staff of food pantries on the Dietary Guidelines could help at-risk populations that visit food pantries meet the dietary recommendations and help prevent the development of diet-related disease (Baumler et al., 2013; Akobundu et al., 2004.)

Community food pantries leave something to be desired among consumers because of the limited variety of foods and the lack of quality foods that pantries have to offer. Overall, the ideal food pantry for food pantry consumers would be set up to be similar to a grocery store (Kuhls et al., 2012). Aware of the high prevalence of food pantry visits among food-insecure populations, Dammann & Smith (2009) focused on perceptions of food pantry consumers and found that food pantry customers reported using food pantries as a last resort because of poor variety in food selection and outdated food. Consumers were aware that the overwhelming amounts of starchy foods, such as pasta and potatoes, are inexpensive and easy to distribute, but they still desired more selections. When interviewed, food pantry consumers agreed that food pantries should provide more choice in order to limit food waste and meet food preferences. Consumers wished to increase their opportunities to receive fresh foods and get fewer boxed and canned goods. While food pantry consumers receive food goods at no cost, the distribution environment ought to consider customers' preferences, opinions, and needs.

Several community food pantries have made changes to increase access, improve the quality and variety of foods, and to meet the taste preferences of their customers. For instance, food pantry consumers often live far from the nearest food pantry, so mobile pantries and school-based pantries are a new form of distribution to reach those in need. Transportation is a great concern among food-insecure households because of high gasoline prices and a lack of public and/or personal transportation (Reyes et al., 2013; Sund, 2013; Dammann & Smith, 2010; Dammann & Smith 2009; Smith et al., 2010; Wiig & Smith, 2008; Richards & Smith, 2007; Townsend et al., 2001). Mobile markets often offer a choice-based distribution style, where consumers can select what they like, and they receive fruits and vegetables at no charge. A successful implementation of these mobile markets is the Greater Chicago Food Depository's ProduceMobile (GCFDP) program that makes 50 regular stops each month to highly food-insecure areas. The GCFDP has become a success and served 200,000 people in 2012 (Sund,

2013). Another successful distribution method is community food closets, which offer 3-day emergency food kits to local agencies that provide other services, such as health clinics, to at-risk populations. These food closets provide a “one stop shopping” location for people who would otherwise not be able to travel to community food banks for emergency food distribution (Cotugna et al., 2012). Other food pantries help alleviate childhood hunger by implementing school-based food pantries for at-risk families to have a convenient location for household emergency food assistance (Cotugna, 2012). As communities implement these distribution improvements, at-risk populations may have an increased chance at successfully implementing the Dietary Guidelines 2010.

Farmers are also coming together to help alleviate the barriers to accessing fresh foods among food-insecure populations with the use of farmers markets. Farmers markets give communities a food resource that would otherwise not be present in the food environment. When studying the impact that farmers markets have on fruit and vegetable consumption among low income and minority households, Spalding et al. (2012) found that farmers markets decrease perceived barriers to fresh produce access. The data regarding any change in fruit and vegetable consumption among participants were limited, but utilization of farmers markets gave participants access to fruits and vegetables that the surrounding food environment did not normally provide. The Food Bank of Central New York utilizes farmers markets in their food donation programs to increase fruit and vegetable consumption among food insecure populations. Neal et al. (2012) studied a short intervention conducted in 2010 by the Food Bank of Central New York that included nutrition education and credit to be used at participating farmers markets in New York. Individuals who attended one of the 36 nutrition education lessons received 10-15 Health Bucks that were redeemable at participating farmers markets. Data analysis revealed that participants redeemed 78% of the distributed credits and that 90% of the farmers engaged with new consumers because of the nutrition education programs. Providing farmers markets in these communities connects low-income and food-insecure populations with access to fresh produce that may not be present in the surrounding food environment.

The New York Emergency Food System has an initiative that encourages community engagement and physical activity through urban farming. Kusovitsky et al. (2012) followed the

grant program, funded through United Way of New York City, which began in 2001. It provides access to fresh fruits and vegetables to low-income populations by cultivating backlot farms, community garden plots, rooftop farms, and indoor and outdoor hydroponic systems. Harvested vegetables from these urban farms, which annually yield about 1,200 pounds of produce, are delivered to food emergency systems in New York City. In 2012, 75% of the farms were still in operation. This initiative connected an urban, low-income, and food-insecure population with access to fresh produce not available in their surrounding food environment and also created positive lifestyle changes to this at-risk population (Kusovitsky et al., 2012).

Food-Related Perceptions, Attitudes, and Behaviors

Behavior is another key determinant of a person's weight and nutritional status. Understanding how a low-income population interacts with the food environment differently from other populations is crucial to effectively initiate a positive intervention. As stated previously, low-income populations are susceptible to diet-related diseases, food insecurity, food insufficiency, and constraints within their food environment. Studying attitudes and behaviors that low-income populations have about food gives insight on how to tailor messages regarding appropriate healthcare practices to meet their specific needs. Examining how behavior serves as a barrier to achieving a healthful lifestyle in this population gives the multidimensional focus necessary for promoting desirable eating patterns. Working together and understanding the perceptions, attitudes, and concerns of low-income populations will move health care and public health practitioners' efforts forward with this at-risk population.

At-risk populations eat at home more regularly than eating out at full-service or fast-food restaurants. A *New York Times* article by Bittman (2011) criticized the cost of eating out as opposed to eating at home in his article "Is Junk Food Really Cheaper?," where he compared the cost of a home-cooked meal to the cost of a McDonald's meal for two. Although this article gave a cost comparison between two differently prepared meals, the author assumed that low-income populations eat solely outside of the home. When surveying 1,500 low-income households across the U.S., Seman et al. (2012) found that 79% of families ate dinner at home five or more nights a week, with at least four of these dinners made from scratch, and 85% of families reported that healthy dinners were important to them. Therefore, it is incorrect to assume that low-income populations solely eat meals prepared outside of the home. Health care providers should provide interventions based on recognition that at-risk populations are preparing most foods at home.

Strong evidence indicates that diet contributes to an individual's health and weight status, yet studies show that mothers in low-income populations overwhelmingly do not understand the connection between health and diet, and this disconnect may contribute to a poor diet and poor health (Dammann & Smith, 2009). The disconnect regarding their diet and health status may be the result of the Dietary Guidelines not reaching these women. Dammann & Smith (2009) studied a group of ethnically diverse low-income Minnesotan women, and found that participants

exhibited a lack of understanding that certain diseases have dietary risk factors. These women believed that a healthful diet is necessary only after health complications occur, such as high cholesterol, type 2 diabetes, and hypertension. These women believed that health complications are purely hereditary—a re-occurring theme in much of the literature. Despite the high rates of overweight/obesity in this study, participants believed that diet had very little to do with their current health status. Also, the women who firmly believed in the concept of hereditary playing a role had significantly higher BMIs than did the other women in the study (Dammann & Smith, 2009). The belief of heredity playing a significant role in BMI status gave these women a lack of accountability for their food-related behaviors. To avoid judgments during counseling, health professionals would benefit from learning their clients' health beliefs and discussing diet-related risk factors for common diseases with them.

Commonly in the literature, participants list several ideas of what it means to follow a healthful diet but fail to mention any of the Dietary Guidelines (Reyes et al., 2013; Dammann & Smith, 2009; Eikenberry & Smith, 2004). One participant in a qualitative study reported that ginger ale soda is more healthful than cola because of its "lower sugar content." Also, households reported that protein foods such as meats and eggs are more important for nutrition than are fruits and vegetables (Dammann & Smith, 2009). These examples are of concern because although these individuals perceived that their increased animal protein intake and swapped soda flavors were healthful, their dietary choices were still contributing risk for diet-related diseases. When working with low-income clients, education on diet-related diseases and preventative and treatment strategies is needed because the diet-disease connection is not well understood among this population and may be contributing to their current health risk status.

Several studies show that low-income mothers of overweight and obese children do not view their children as having an unhealthy weight status (Davis et al., 2013; Hughes et al., 2010; Dammann et al., 2009). Overarching themes that arose in these studies, which all looked at how mothers perceive their children's weight status, were: heredity playing a role, family and environmental factors affect the child's weight, and mothers not defining healthy weights using standardized growth chart measures. The first theme was that nearly all mothers believed that their children's weights were hereditary and that their children would be overweight regardless

of their diets. Although they believed that diet has no impact on their child's weight, mothers of overweight and obese children also believed that the environment they live in along with family influences contributed to their child's weight status. These beliefs resulted in tension, with the mothers feeling at fault for their child's weight status because of their genetics and food-related behaviors. Although these parents seemed to be aware of their children's high weight status, they didn't measure their child's weight by growth chart standards, and they tended to underestimate their child's degree of being overweight. By describing their children relative to their clothing size, how their clothes fit, and their height, parents had their own definition of desirable weight status (Hughes et al., 2010). Health professionals may have interventions that are more successful if they understand these perceptions when working with low-income populations that have children with an overweight or obese weight status.

Families provide their children with nutritional attitudes, values, and perceptions about food through role modeling and by providing food for the household (Richards & Smith, 2007). The attitudes of many low-income households is that food is for "reward and stress relief," which puts their children at a higher risk for chronic diet-related disease and illnesses, especially since many children in these households trend toward overweight and obese status (Hughes et al., 2010). Adults in low-income households with children often use unhealthy foods as a reward to help temporarily shield their children from their impoverished status, which then can shape lifelong eating behaviors that result in adverse health outcomes. Hughes et al. (2010) found that low-income parents of overweight and obese children reported using less healthful foods as treats that they could afford, in order to compensate for the nonfood "treats" that they could not afford. These households also reported to these researchers the use of food as a relief from the stress of the constant constraints of living with limited resources, because of its relative affordability. Parents understood the implications of their actions yet believed that these behaviors provided a nurturing environment for their children despite the negative health outcomes. Parents who were themselves overweight or obese felt the tension between providing their children with current happiness via less healthful food options, and future unhappiness via negative body image because of being overweight or obese, which these parents reported experiencing in their own lives (Hughes et al., 2010).

Homelessness and Food-Related Behaviors

Homeless children have a life of instability and uncertainty because of the pressing need to find shelter in addition to obtaining food and maintaining health. In cases of extremely low-income status, homeless parents shape attitudes about food according to its availability. In a study by Richards & Smith (2007), the constraints of homelessness caused some parents to encourage their children to overeat at times, past the point of fullness, in order to compensate for potential future hunger. As parents pressure their children to eat more and increase caloric intake, they create behaviors that result in overweight and obese status in their children. This may explain the hunger-obesity paradox previously mentioned. On the other hand, homeless parents may at times encourage dieting and food restriction to prevent weight gain in their children. Homeless children are affected by these messages, as evidenced by overweight children reporting dissatisfaction with their body image and at times restricting their own food intake regardless of hunger. However, parents send mixed messages to their children with encouragements to restrict food intake to prevent weight gain at some meals but to increase intake at other meals because of concerns about hunger (Richards & Smith, 2007). This is a public health matter since food restriction has been associated with increased body fat, decreased lean muscle mass, and quicker weight gain in response to re-feeding periods (Dinour et al., 2007). Homeless families face a greater disadvantage in food security than low-income families with stable shelter. Future interventions by homeless shelter staff should include counseling for families to constructively address these attitudes and behaviors.

Published literature about children's awareness and perceptions of hunger and poverty is limited. Although adults may attempt to shield children from hunger and awareness of their economic constraints, children do become aware of their food situation and report feeling hunger and food insecurity. A study by Graham et al. (2013) with children residing in Minnesota homeless shelters shed light on how children are affected by poverty and hunger. Because children living in homeless shelters typically cannot take dining room foods or fresh foods to their rooms, according to the shelters' policies, they often resort to making less healthful food options to assuage later hunger. Also, adolescents in this study agreed that there was a lack of access to fruits and vegetables within their food-shopping environment. These children reported buying snacks, such as candy and other processed foods, to take to their rooms in order to

alleviate their hunger in the night. These coping strategies resulted in the children eating 20-24% of their total energy intake from added sugars, with 8% from soft drinks. More seriously, these children also resorted to eating ice cubes (a practice known as pica, which can lead to health problems) to alleviate their hunger pains. If children are worried about their basic needs to satisfy hunger, then they cannot function properly in school and social activities (Nord & Parker, 2010). Living in emergency shelter environments is a unique lifestyle that differs greatly from that of other low-income populations. Food insecurity in childhood is associated with adult obesity, as well as many negative physical and mental outcomes that affect development and well-being, which were mentioned previously (Nord & Parker, 2010; Smith & Richards, 2008). A call for societal and community interventions is needed to prevent the homeless environment from affecting these children in negative ways.

Why Do People Buy What They Buy?

Two main themes that occur in the literature regarding food-purchasing determinants are price and perishability. When the price of healthier food options, such as whole grains versus enriched grains, is higher, low-income populations buy the less expensive option. In addition, people with limited incomes will choose foods that can last for a month versus buying fresh produce (Fowles et al., 2012; Dammann & Smith, 2009).

Price is the main factor determining how low-income households prioritize their food purchases, which results in the purchase of more foods with added sugars, sodium, and fats, and fewer nutrient-dense foods. Although someone with a limited income may be educated about which foods are healthful and nutrient-dense, the prices of those foods in comparison to less-costly calorie-dense alternatives makes healthful choices less attractive. By buying less expensive, less healthful alternatives, low-income populations increase their food spending ability but also their intake of added fats, sugars, and sodium (Aggarwal et al., 2011). Even if nutrient-dense foods are within the same price range as calorie-dense foods, people on a limited income may hesitate to opt for more-healthful alternatives for fear of wasting their money if they find the food unpalatable (Dressler & Smith, 2013; Noia & Byrd-Bredbenner, 2013).

Why price is a factor for healthful eating, but not for smoking cessation, was a research question that Binkley (2009) studied when looking into how the pricing of food contributes to the dietary choices of low-income populations. Along with food price inflation, tobacco prices have recently increased tremendously. Although people with low-incomes are less likely to start smoking than other SES populations, they are also less likely to quit. Thus, low-income populations smoke at higher rates than any other population. Their desire to continue smoking was attributed in this study to perceptions of future value: they have little to look forward to in the future and their reluctance to quit smoking is the result of wanting to hold on to present pleasures amidst the anxiety and stress associated with their low-income status. Changing pleasurable addictive behavioral patterns for a potential happier and healthier future is not a worthy health investment among smoking low-income populations (Binkley, 2009). Smoking habits may be similar to risky dietary patterns, with regard to the low-income population's unwillingness to change their current pleasurable but unhealthy lifestyle for the possibility of a

future healthier one. Future studies on this subject would be beneficial, including considering the availability of tobacco products in comparison to healthful food options sold in low-income neighborhoods.

The value that food has among low-income populations, and their relationship to food, is a complex subject and it would be beneficial to future clinical practice to incorporate multisystemic counseling strategies to facilitate positive behavioral change. Lipsky (2009) stated, “Available evidence suggests that food choice in developed countries is an enormously complex behavior that results from the personal management of a multidimensional value system that involves the negotiation of intricate personal preferences, which in turn are influenced by numerous social, personal, and environmental factors.” Lipsky’s analysis of food cost suggests that consumers interact within a food environment that is much more complex than a simple response to food price. Published literature demonstrates that family and personal preferences, as well as economic and environmental situations, greatly influence eating behaviors (Dressler & Smith, 2013; Malhotra et al., 2013; Shin et al., 2013; Fowles et al., 2012; Seman et al., 2012; Inglis et al., 2009; Wiig & Smith, 2008; Frazao et al., 2007; Seymour et al., 2004). For instance, Wiig & Smith (2008) showed that low-income populations allocated more money to meats and other protein products, such as eggs, than to fruits and vegetables because of the perceived importance of meat in their diets. This preference for meat over fruits and vegetables is attributed to upbringing, ethnic traditions, taste, the perceived importance of meat in meals, and the versatility of meats in meal preparation. Whether education can counteract these engrained attitudes towards meat and other protein products relative to fruits and vegetables among this population is questionable. Future research needs to consider the multidimensional factors of low-income status as it pertains to food choices, diet quality, and diet-related diseases.

Knowing how low-income populations and populations with food insecurity perceive their grocery shopping environment helps to clarify what attracts and deters them from purchasing different foods. Webber et al. (2010) conducted a qualitative research study on the perceptions of a low-income population on the food and retail qualities of grocery stores, giving insight into what they believed were important aspects when they shopped for fruits and vegetables. The five overarching themes that arose were: store venue, internal store environment,

product quality, product price, and the participants' relationships to the store. They reported not purchasing certain food items if they perceived the prices to be too expensive or if their travel to get to the store was too difficult. They also believed that the internal environment of a store was important, and lamented the lack of variety, inconsistency of stocked items, cramped aisles, and unhelpful staff. They looked for the freshest produce, but found that the produce from stores within their neighborhoods spoiled rapidly. When selecting produce, their most common methods were to buy whatever was on sale or to buy lower-priced but over-ripe produce. They reported that canned goods were often close or past the "best used by" shelf life date. As a result, food safety was of concern to most participants in this study because they lacked knowledge of where the food was grown, processed, packaged, and transported. Convenience was important because it resulted in less stress if they could access stores near their work, home, or during breaks throughout the day. However, more convenience often was linked to higher prices. When discussing store location and weighing the merits of location and convenience, the issue of physical safety was of concern, but it would not deter these participants from shopping at their favorite stores (Webber et al., 2010). Future public health efforts should address these concerns.

Nutrition Assistance Programs and Policies

Programs and policies in the U.S. help shape the eating habits of low-income Americans in need of nutrition assistance. In this section, I will discuss the implications that the ever-changing climate of government policy has on the consistency of nutrition assistance and public health interventions. Literature shows that government nutrition assistance programs, such as the Special Supplemental Nutrition Program for Women Infants and Children (WIC), Supplemental Nutrition Assistance Program (SNAP), and the School Breakfast and Lunch Programs, are very beneficial to the health status of low-income populations. As discussed in a previous section of this report, many local communities and outreach groups have worked together to create programs that further aid at-risk populations, such as neighborhood gardens, food pantries, farmer markets, and home food delivery systems. With the current state of our nation, including high unemployment and under-employment rates, high poverty rates, food price increases, and the passage of the Farm Bill in early 2014, nutrition assistance policies and public health programs are a lifeline for many Americans to achieve food security and adequate dietary quality.

SNAP gives households of all ages with limited resources benefits specifically for eligible food purchases at authorized food stores. The benefits, which are transferred monthly to the household's SNAP debit card, are not intended to cover all of a family's food costs, hence the term "supplemental." SNAP, formerly known as the Food Stamp Program, is the largest domestic hunger safety net in the U.S. and is managed by the USDA's Food and Nutrition Service. In order to be eligible for SNAP, individuals must meet the program's income, resources, deductions, immigration status, and employment requirements. Special considerations are given to the elderly or disabled. Income requirements and SNAP benefits are shown in Tables 1 and 2, respectively. Eligible purchases for SNAP include cold foods and beverages intended for consumption at home, vegetable seeds and plants that produce food for consumption, and energy drinks that have a Nutrition Facts label rather than a Supplemental Facts label, since the latter would classify the drink as a nutrition supplement (USDA Food & Nutrition Service, 2014). SNAP does not allow the purchase of hot food items, alcohol, nutrition supplements, medicine, tobacco, and other nonfood products.

Table 1: FY 2014 SNAP Income Requirements (USDA Food & Nutrition Service, 2014)

Household Size	Gross monthly income (130 percent of poverty)	Net monthly income (100 percent of poverty)
1	\$1,245	\$ 958
2	1,681	1,293
3	2,116	1,628
4	2,552	1,963
5	2,987	2,298
6	3,423	2,633
7	3,858	2,968
8	4,294	3,303
Each additional member	+436	+335

Table 2: FY 2014 SNAP Benefits (USDA Food & Nutrition Service, 2014)

People in Household	Maximum Monthly Allotment
1	\$ 189
2	\$ 347
3	\$ 497
4	\$ 632
5	\$ 750
6	\$ 900
7	\$ 995
8	\$ 1,137
Each additional person	\$ 142

Some people who receive SNAP benefits are confused about the program, and some even report breaking the law to compensate for their perceived lack of benefits. Problems with SNAP among beneficiaries include lack of knowledge about SNAP benefits distribution, abuse, and conflict of eligibility, according to a qualitative research study by Dammann & Smith (2009). Some beneficiaries in the study reported that their SNAP benefits cannot last them through the month and were frustrated with the insufficient funds, revealing that these beneficiaries were unaware of the supplementary role of SNAP. As a result, beneficiaries attempted to budget all of their food expenditures within the SNAP benefit allotment each month. Only one participant in this study reported that her caseworker informed her about the supplementary role. Some participants reported having to visit soup kitchens and community dinner programs frequently, while others combined SNAP benefits with their non-household family members or friends in order to increase their spending power. Participants also reported that a common practice in their communities was to buy SNAP benefits from other people in order to make it to the next

distribution, which is a federal offence. Also, participants in this study reported frustration with the income requirements. To continue to provide food for her family and to pay her other bills, one participant reported generating less income by working fewer hours than she could have, in order to prevent her SNAP benefits from being reduced or discontinued, since a few more hours of pay would have caused her to be above the program's income requirements (Dammann & Smith, 2009). When working with clients eligible for or enrolled in SNAP, nutrition professionals would benefit from withholding judgments and having open discussions about SNAP benefits and barriers.

SNAP participation is crucial for the well-being of at-risk populations, yet only one in five people in the U.S. who are eligible for SNAP participate in the program (Food Research & Action Center, 2014). SNAP changed dramatically because the stimulus package expired in 2013, and in November 2013, 47,033,135 people were dropped from SNAP enrollment. In addition, the most recent 2014 Farm Bill cut SNAP benefits nationwide by \$8.7 billion. Lower enrollment creates an environment that will likely lead to more people in the U.S. experiencing food insecurity.

Community outreach and education can help people eligible for SNAP benefits enroll, in order to alleviate food insecurity in communities. Studies show that most populations that are eligible for SNAP and don't participate are unaware of either the existence of SNAP or of their eligibility. For example, when interviewing eligible populations in Los Angeles, McCarthy et al. (2012) found that 83% of participants did not receive SNAP benefits, known as CalFresh in California. Among participants not receiving benefits, 76% didn't know anything about SNAP. Language, literacy, and non-citizenship contributed to the barrier of knowledge about SNAP.

A common theme of concern in the literature about SNAP is the "food stamp" cycle mentioned previously in the food insecurity section (Leung et al., 2013; Leung et al., 2012; Dammann & Smith, 2009; Dinour et al., 2007). Most SNAP households do not spend one-fourth of their benefits each week. Rather, they follow the "food stamp" cycle, as Dinour et al. (2007) described it, which is a monthly eating pattern of about 3 weeks of overeating when food stamps and money are available, followed by a 1-week period of involuntary food restriction when

household food sources are depleted. As mentioned earlier, this is of health concern since cyclical food restriction is associated with increased body fat, decreased lean muscle mass, and quicker weight gain in response to the re-feeding period. When there is plentiful food at the beginning of the month, a pattern of binge eating occurs, which is another factor contributing to the food insecurity-obesity paradox. This cycle also affects children's eating habits, because caregivers typically give more snacks and fast-food at the beginning of the month to compensate for the recent period of involuntary food restriction. Parents who attempt to shield their children from food insecurity are more likely to offer less-healthy "reward food" options to their children at the beginning of the month, when the household's access to food is relatively high (Dinour et al., 2007). Having a consistent monthly restrictive eating cycle, such as the "food stamp" cycle that SNAP recipients experience, reduces the health effectiveness of nutrition assistance for a food-insecure population.

Qualitative research reveals that the monthly timing of the distribution of SNAP benefits serves as a barrier to breaking the "food stamp" cycle (Dammann & Smith, 2009; Leung et al., 2013). Literature shows that families on SNAP and previous food stamp programs use up their benefits before the end of the month (Leung et al., 2013; Dammann & Smith, 2009; Dinour et al., 2007). Beneficiaries report that the monthly distribution of SNAP benefits makes it difficult for them to budget their food needs, because an entire month is too long of an interval for them to manage (Dammann & Smith, 2009). The number of days between receiving SNAP benefits is significantly negatively associated with food energy intake (Dinour et al., 2007). Experts agree that changing SNAP benefits to a biweekly distribution cycle, rather than monthly, could alleviate the stress of trying to purchase enough food to last for a month. Biweekly distributions would also make it easier for SNAP beneficiaries to buy more perishable fresh produce, rather than processed foods, which have a longer shelf life (Leung et al., 2013). Just by implementing a relatively simple change in policy, that is, by shortening the interval between SNAP benefits distributions, the diet quality and health of at-risk populations could improve.

Positive changes in policy can lead to positive behavior changes within at-risk populations participating in supplemental nutrition assistance programs, as evidenced by two food policy changes in WIC in 2009. The first policy change affected the 8.9 million infants,

children, and pregnant/postpartum women who receive WIC packages (Whaley et al., 2012). In 2009, WIC revised their food package policies to address two main concerns with WIC participants: high obesity and low breastfeeding rates. Because obesity is inversely related to income among women in the U.S., policy makers decided to make revisions to WIC food packages to include the addition of whole-grain options, reduction of the fat content in milk, and, most notably, monthly fruit and vegetable cash value vouchers. The implementation of fruit and vegetable vouchers was coupled with stocking requirements for WIC vendors to carry more fruits and vegetables, along with the other healthful foods. This has led to a minor price reduction trend of fruits and vegetables among WIC vendors across the U.S. (Zenk et al., 2014).

The occurrence of breast-feeding rates among WIC participants increased since the implementation of the second 2009 WIC policy change (Whaley et al., 2012). In the past, WIC was criticized for distributing infant formula to mothers of infants and the very low rate of breastfeeding among WIC beneficiaries. WIC participation was directly associated with lower rates of breastfeeding when compared to non-WIC participants. The 2009 policy change was designed to incentivize women to breastfeed their children. The new WIC food package increased the amounts of food for mothers who fully breastfeed, reduced the amount of formula for mothers who partially breastfeed, calibrated formula amounts for infants by age, and postponed complementary infant foods. In California, WIC policy did not routinely allow infant formula to be given to breastfeeding mothers in the first month postpartum. Also, front-line WIC staff were more involved in educating participants on the importance of breastfeeding. Support and education, coupled with the incentivized packages, led to improved rates at which WIC participants breastfeed. Data in California showed that issuance of infant formula decreased and that breastfeeding rates among WIC participants significantly improved with the new policy change (Whaley et al., 2012).

The National School Lunch / Breakfast Programs are another federal safety net intended to give meals to children of at-risk households and alleviate food insecurity. The federal government funds the School Lunch and Breakfast programs and is implemented by school districts. The National School Lunch Program (NSLP) operates in public and nonprofit private schools and residential child care institutions. Over 85,000 schools participate in the School

Breakfast Program (SBP). Schools provide children from households that have below 130% of the federal poverty line with free lunches. Children between 130 and 180% of the federal poverty line receive reduced price lunches. The NSLP has the potential to reduce household food insecurity by providing meals to children who may otherwise have to skip them, freeing up household resources to feed other family members, and reducing uncertainty regarding sufficient amounts of food. Bartfeld & Ahn (2011) pushed for the national implementation of the SBP since it further helped families alleviate the stresses of food insecurity. Studies show that when combined, the NSLP and SBP lower the probability of marginal household food insecurity (Coleman-Jensen et al., 2013; Bartfeld & Ahn, 2011). Previous studies showed that implementation of these programs were highly beneficial because of the higher fruit and vegetable intake among low-income children who participated in these programs (Hiza et al., 2013).

Current U.S. Food Costs

Current information on food costs in the U.S. is needed in order to adequately describe today's food environment and its link to Americans' dietary status and to determine whether low-income families can afford healthier food options. Food cost is likely linked to health status. In 2008, food prices around the world skyrocketed. Since 2008, food prices have continued to increase. With this rise in food costs came increased rates in the U.S. of food insecurity and decreased health status. How researchers measure food costs, when they measure food costs, and the reports of their conclusions by the mass media help to shape the public's perceptions of and attitudes towards healthful foods.

The Thrifty Food Plan is the monthly budget for food that the USDA developed to determine the maximum allotment for SNAP (Carlson et al., 2007). The Thrifty Food Plan gives a budget for people with respect to their gender, age, and family size. Table 3 shows the USDA's Thrifty Food Plan costs, along with three other more-expensive food plans, averaged for 2013. Based on Table 3, a 26-year-old female living alone would be expected to spend \$194.88 per month on foods (\$162.40/month plus 20%, or \$32.48, for living alone, or \$194.88 per month). This comes to \$45 per week and \$6.28 per day. If she received SNAP benefits, she would receive a maximum of \$189 per month (per Table 2), depending on her income, etc., which would offset most of her food expenses on her Thrifty Food Plan. Although the USDA adjusts the Thrifty Food Plan budget monthly, the last time that the Thrifty Food Plan meal guide was revised was in 2006 (Carlson et al., 2007). Since food costs have risen drastically since 2008, it is possible that the Thrifty Food Plan meal guide does not meet the current budgetary needs of Americans today nor the Dietary Guidelines 2010.

Table 3: Official USDA Food Plans: Cost of Food at Home at Four Levels, U.S. Average, June 2013 (USDA, 2013 c).

Age-gender groups	Weekly cost ²				Monthly cost ²			
	Thrifty plan	Low-cost plan	Moderate-cost plan	Liberal plan	Thrifty plan	Low-cost plan	Moderate-cost plan	Liberal plan
Individuals³								
Child:								
1 year	21.50	28.50	32.40	39.30	93.30	123.50	140.40	170.40
2-3 years	23.40	29.60	35.80	43.50	101.50	128.40	155.20	188.40
4-5 years	24.40	30.80	38.00	46.20	105.80	133.40	164.80	200.40
6-8 years	31.10	42.70	52.00	61.10	134.70	185.00	225.20	264.80
9-11 years	35.30	46.70	60.10	70.00	152.90	202.40	260.30	303.20
Male (M):								
12-13 years	38.00	53.60	67.00	78.40	164.60	232.20	290.20	339.80
14-18 years	39.00	54.60	69.00	79.10	169.10	236.50	299.10	342.90
19-50 years	42.00	54.10	68.00	83.30	182.00	234.60	294.80	360.70
51-70 years	38.40	51.20	63.60	76.50	166.20	221.70	275.60	331.40
71+ years	38.70	50.80	62.90	77.30	167.80	220.20	272.40	335.10
Female (F):								
12-13 years	38.10	46.20	55.40	67.90	165.10	200.30	240.10	294.20
14-18 years	37.40	46.30	56.00	68.90	162.10	200.80	242.80	298.40
19-50 years	37.50	47.00	58.10	74.10	162.40	203.70	251.70	321.20
51-70 years	36.90	46.00	57.20	68.40	160.10	199.10	247.70	296.40
71+ years	36.10	45.70	56.60	68.00	156.30	198.10	245.10	294.70
Families								
Family (M&F) of 2:⁴								
19-50 years	87.40	111.30	138.70	173.10	378.90	482.10	601.10	750.20
51-70 years	82.80	106.80	132.80	159.40	358.90	462.90	575.60	690.50
Family of 4: Couple (M&F), 19-50 years and children—								
2-3 and 4-5 years	127.30	161.60	200.00	247.10	551.70	700.10	866.40	1070.80
6-8 and 9-11 years	145.90	190.60	238.20	288.50	632.00	825.70	1031.90	1250.00

¹The Food Plans represent a nutritious diet at four different cost levels. The nutritional bases of the Food Plans are the 1997-2005 Dietary Reference Intakes, 2005 Dietary Guidelines for Americans, and 2005 MyPyramid food intake recommendations. In addition to cost, differences among plans are in specific foods and quantities of foods. Another basis of the Food Plans is that all meals and snacks are prepared at home. For specific foods and quantities of foods in the Food Plans, see *Thrifty Food Plan, 2006* (2007) and *The Low-Cost, Moderate-Cost, and Liberal Food Plans, 2007* (2007). All four Food Plans are based on 2001-02 data and updated to current dollars by using the Consumer Price Index for specific food items.

²All costs are rounded to nearest 10 cents.

³The costs given are for individuals in 4-person families. For individuals in other size families, the following adjustments are suggested: 1-person—add 20 percent; 2-person—add 10 percent; 3-person—add 5 percent; 4-person—no adjustment; 5- or 6-person—subtract 5 percent; 7- (or more) person—subtract 10 percent. To calculate overall household food costs, (1) adjust food costs for each person in household and then (2) sum these adjusted food costs.

⁴Ten percent added for family size adjustment.

As mentioned throughout this review, there is overwhelming literature confirming that healthful food options are more expensive than less healthful options. However, research is needed to determine the reasons for the extra costs for more-healthful foods, since current literature shows that there is no definite explanation for the price variance (Drewnowski, 2013; Rao et al., 2013; Scientific American, 2012; Waterlander et al., 2010; Katz et al., 2011; Bittman, 2011; Monsivais & Drewnowski, 2009; Cassady et al., 2007; Cullen et al., 2007; Frazao et al., 2007). Rao et al. (2013) conducted a systematic review and meta-analysis comparing world-wide food costs data, and found that more-healthful food options cost an additional \$1.50 per 2,000 kilocalories, which is the amount of calories that a typical individual needs to achieve energy balance per day. An example of a more-healthful option versus a typical choice is whole wheat bread as opposed to enriched wheat bread. An individual would have to allot \$46.50 more to his or her monthly grocery budget in order to incorporate foods that are more healthful. Table 4 illustrates the additional costs to existing food budgets for each member of a household. An extra \$1.50 per day may not seem to be a large price to pay, but as Table 4 illustrates, this additional cost adds up over a month, and may not be feasible for a family experiencing economic strain because of limited resources (Rao et al., 2013). For instance, if the woman mentioned previously has to spend \$194.88 each month for food and is able to meet her dietary requirements with typical foods as opposed to more-healthful foods, she would have to spend a total of \$241.38 per month in order to purchase foods that are more healthful. Since we know that healthful food costs \$1.50 more per day according to Rao et al. (2013), then it would be advisable for the USDA to review the Thrifty Food Plan meal guide (Carlson et al., 2007) to ensure that it incorporates more healthful foods, as opposed to typical foods, to meet the Dietary Guidelines 2010.

Table 4: Additional Monthly Costs by Household Size for More-Healthful Foods (Rao et al., 2013)

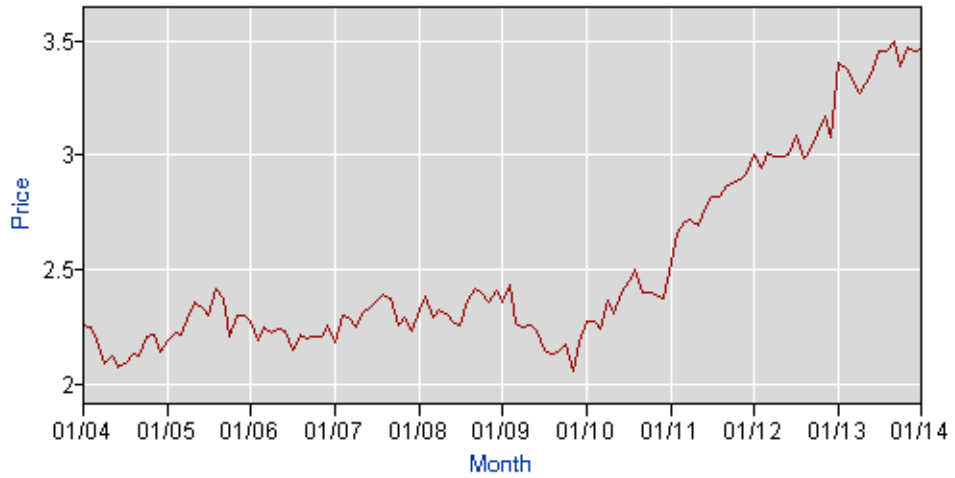
Household Size	Additional cost to existing food budget to eat more-healthful food options for 31 days, based on \$1.50/day
1	\$46.50
2	\$93.00
3	\$139.50
4	\$186.00

As food costs continue to rise, at-risk populations with limited resources face greater barriers in obtaining adequate dietary quality, especially since food options that are more healthful are priced higher than less-healthful options. For instance, the price of enriched wheat bread as of 2014 is \$1.37 per pound, while whole wheat bread costs 50% more, at \$2.07 per pound. Lean and extra lean ground beef chuck cost \$5.02 per pound, which is 40% more than the price of regular ground beef chuck, which is \$3.59 per pound (Bureau of Labor & Statistics, 2014). Although Rao et al. (2013) adjusted their food costs per inflation, they noted that their study was conducted with data collected up to December 2011 and did not reflect the inflation in food prices that continues to rise. Figure 1 depicts data from the Bureau of Labor & Statistics and graphically shows the inflation in food prices from 2004-2014, with each chart showing the cost average in U.S. cities of a top commodity.

Figure 1: Various Top-Pick Commodity Food Costs from 2004-2014 from the Bureau of Labor & Statistics (Bureau of Labor & Statistics, 2014)

Consumer Price Index - Average Price Data

Series Id: APU0000703112
Area: U.S. city average
Item: Ground beef, 100% beef, per lb. (453.6 gm)



Area: U.S. city average
Item: Chicken, fresh, whole, per lb. (453.6 gm)

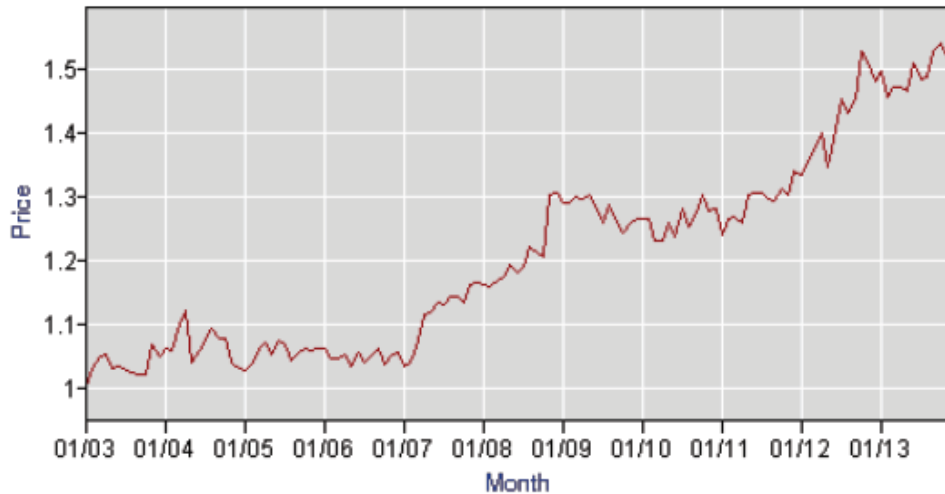
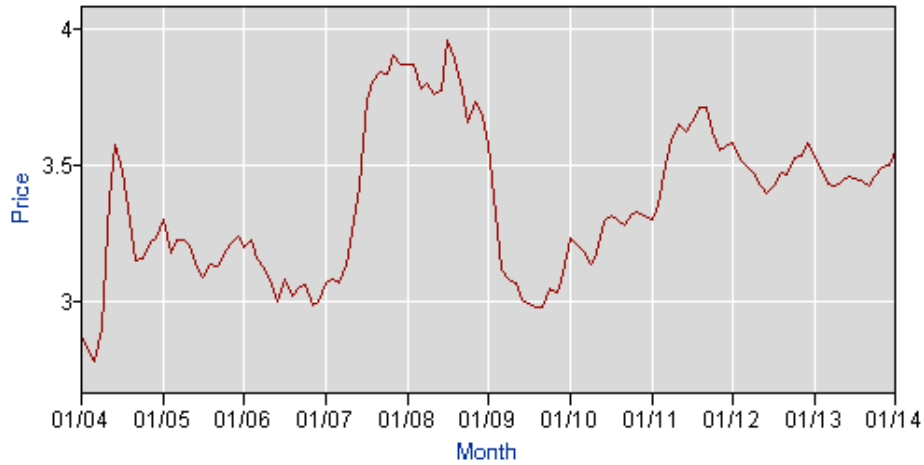


Figure 1, continued: Various Top-Pick Commodity Food Costs from 2004-2014 from the Bureau of Labor & Statistics (Bureau of Labor & Statistics, 2014)

Consumer Price Index - Average Price Data

Series Id: APU0000709112
Area: U.S. city average
Item: Milk, fresh, whole, fortified, per gal. (3.8 lit)



Consumer Price Index - Average Price Data

Series Id: APU0000702212
Area: U.S. city average
Item: Bread, whole wheat, pan, per lb. (453.6 gm)

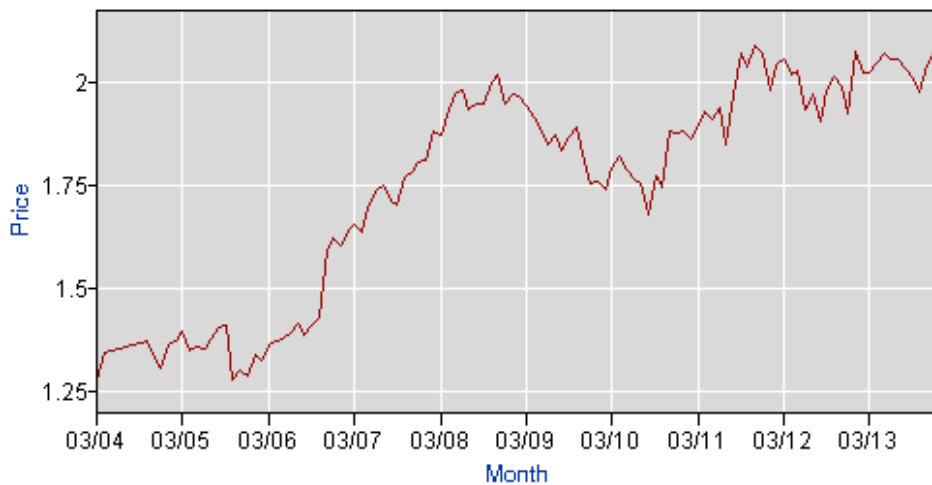
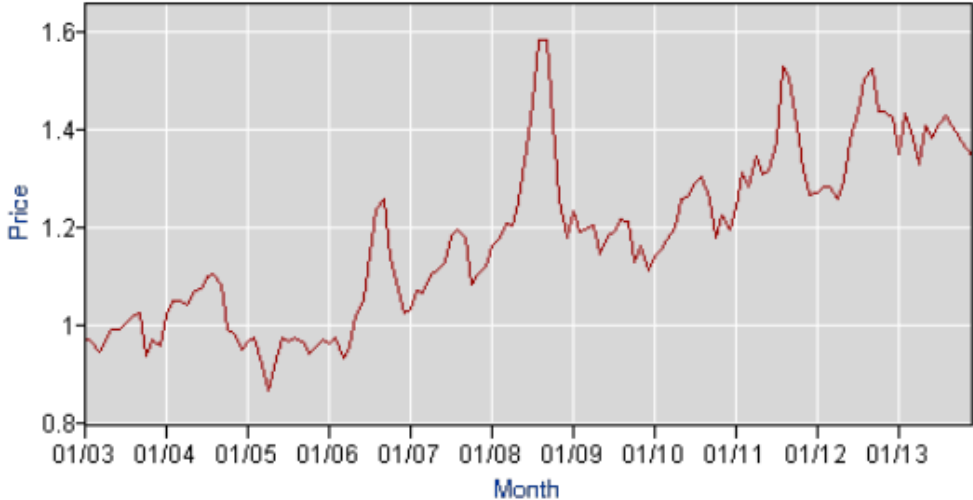


Figure 1, continued: Various Top-Pick Commodity Food Costs from 2004-2014 from the Bureau of Labor & Statistics (Bureau of Labor & Statistics, 2014)

Area: U.S. city average
Item: Apples, Red Delicious, per lb. (453.6 gm)



Comparing the Nutritional Value Versus Price of Foods

Researchers continue to develop new metrics to measure the nutritional value of foods relative to food costs. The energy density to food cost ratio, or determining the ratio between kilocalories (kcal) and the price of different food items, is a measure used to compare the relationship of food cost to health qualities of food that was introduced by Drewnowski (Lipsky, 2009). Since the cost of food is typically negatively related to its total kcal (calorie-density), the energy density/cost ratio for foods with added calories from fats and sugars, such as doughnuts, is high. Alternatively, less energy-dense but more expensive foods, such as fresh fruits and vegetables, have a low energy density/cost ratio. While this measure may provide insight into the affordability of calorie-dense foods as opposed to nutrient-dense foods, its practical applicability is questionable. The ratio is controversial, with Lipsky (2009) stating that “research regarding the relative price of produce should make use of validated measures of price that are commonly used in relevant economics literature, such as serving price or the total price of a market basket of food products.”

A more appropriate tool for measuring the costs and nutritional value of various types of foods is the market basket method, where the cost of foods in the major food groups as purchased is the focus rather than individual nutrients or energy density. When determining whether low-income families can afford healthier food options, Cassady et al. (2007) measured the cost of a market basket containing foods that matched the Dietary Guidelines 2005 to give a clear picture of food purchase options for those living on a low-income. These researchers also measured the cost of a food basket that did not necessarily meet the Dietary Guidelines but that did fit within the constraints of a low-income budget, based on the Thrifty Food Plan meal guide. They concluded that the market basket according to the Dietary Guidelines 2005 would require low-income families to devote 43% to 70% of their food budget to fruits and vegetables. In order to adhere to the Dietary Guidelines, low-income families would have to re-allocate their grocery budgets substantially. The results of this study suggest that the budgetary cost of increasing fruit and vegetable consumption to levels recommended in the Dietary Guidelines may be more of a barrier to healthful eating than the price per serving of fruits and vegetables (Cassady et al., 2007). A multidimensional U.S. policy approach that improves the affordability of fruits and

vegetables for low-income populations, and ensures that they have access to low-cost, high-quality fruits and vegetables, is necessary in order to improve the nation's diets.

To better measure food cost in relation to a healthful diet, the Affordable Nutrition Index (ANI), which measures the nutrient density of a food in relation to its price, was recently introduced by Drewnowski (2013) in response to the aforementioned energy density/food cost ratio, which indicates that fruits and vegetables are more costly in comparison to calorie-dense foods. He reported that while vegetables, in comparison to other food groups, were the lowest-cost food sources for potassium, vitamin A, vitamin C, and dietary fiber, using price per unit weight was not the most favorable measure for foods such as vegetables, since much of their weight is from water, which provides neither calories nor nutrients. Thus, the ANI measures "nutrients per unit cost" instead, in order to identify those foods that provide the most nutritional value for the least amount of money. Vegetables are much more affordable sources of key nutrients than are calorie-dense foods. Foods with the greatest total Nutrient Rich Foods (NRF) scores are sweet potatoes, tomato juices and soups, dark green leafy vegetables, non-leafy vegetables, pumpkin, winter squash, and carrots, with NRF scores for dark green vegetables being significantly higher than scores for other vegetable groups. Overall, the best ANI scores, or the most nutrients per cost, were for sweet potatoes, tomato juices and soups, white potatoes that are boiled or baked, carrots, and dark green vegetables. Processed fruit juices also had high ANI scores (Drewnowski, 2013).

As researchers continue to develop new metrics to compare the price versus the nutritional value of foods, and thus to better serve low-income populations such as those enrolled in SNAP and WIC, they must also consider the typical food choices of consumers as well as nutrition education, according to Drewnowski (2013). This researcher compared the affordability of nutrient-dense foods with the frequency of their consumption, which he based on two 24-hour food recalls in NHANES 2003-2004. His results showed that only two vegetables combined nutrient density, affordability, and widespread consumer acceptance: potatoes (baked and boiled) and carrots. The foods with the highest NRF scores were not the most frequently consumed. Vegetables consumed most frequently were raw tomatoes, tomato sauces, potato chips, and fried potatoes. Tomato juices, processed fruit juices, and tomato soups were among the highest ANI

scores (nutrient-dense foods for the cost), yet their frequency of being eaten was below that of raw tomatoes, tomato sauces, and potato chips (Drewnowski, 2013). Nutrition and public health professionals should consider providing their low-income clients with culturally acceptable menu suggestions that incorporate more foods high in ANI scores.

My One-month Thrifty Food Plan/Dietary Guidelines 2010 Menu

Coupled with the market basket approach (Cassady et al., 2007), I used the ANI food scores (Drewnowski, 2013) to create a menu for one month that, to the best of my ability, met the Thrifty Food Plan (USDA, 2013 c.) budgetary constraints and the food group servings recommended by the Dietary Guidelines 2010 (USDA, 2010). In creating this menu, I also heavily relied on the blog, *Budget Bytes* (2013), and the research by Stewart et al. (2011) that ranked fruits and vegetables by price. This menu for the month of March 2014 is based on the Dietary Guidelines 2010 and the Thrifty Food Plan for a single 26-year-old female on an 1800 kcal diet. I used the USDA's *SuperTracker* food processing software (USDA, 2014) to analyze the nutritional quality of my menu's recipes and food choices to determine if they met the food group recommendations. By creating the menu and putting it into practice by purchasing these items and cooking and eating only these foods during the month of March, I was able to experience some of the barriers that low-income populations have in shopping within these parameters. Also, I was able to see many advantages that I had in shopping within budget within my food environment in Manhattan, Ks. I have divided this section into the following sub-sections: *Personalized Budget and Dietary Guidelines, Menu, Recipes, Shopping Costs, USDA Dietary Guidelines Breakdown, and Personal Reflections.*

Personalized Budget and Dietary Guidelines

For a 26-year-old female living alone, the Thrifty Food Plan allows a budget of \$194.88 per month, as described in detail in the Current U.S. Food Costs section, which amounts to \$45 per week, or \$6.28 per day. For my budget, I disregarded the daily cost and focused on the overall food cost for the menu and staying within budget at the time of purchase at the store. Although breaking down the daily budget cost can be effective in determining excess costs in some areas, it is not applicable within the food environment. Allowing myself an overall budget of \$194.88 for the month gave more flexibility in creating meals, rather than staying within the rigidity of \$6.28 per day.

By staying within a monthly budget, I was able to focus my efforts on following the Dietary Guidelines within that budget, rather than the small daily budget. The personalized food group guidelines that I followed were based on the 2010 Dietary Guidelines' 1800 kcal daily food plan for adults ages 18 years and older. The guidelines are shown in Table 5.

Table 5: USDA Dietary Guidelines for 1800 kcal Daily Food Plan for Adults Ages 18+ (USDA, 2010).

Food Groups	Amounts Recommended	Choice Recommendations
Grains	6 ounce-equivalents	Aim for half whole grains
Vegetables	2 1/2 cups	Aim for dark green and red/orange veggies often
Fruits	1 1/2 cups	Eat a variety
Dairy	3 cups	Low fat
Protein	5 ounce-equivalents	<ul style="list-style-type: none"> - Seafood twice a week - Vary with beans, peas, and nuts - Choose lean cuts of meat/poultry

Menu

Figure 2 shows the menu I created for March following the Thrifty Food Plan budget. I listed the meals and snacks I incorporated into this meal in each column with a special emphasis on fruits and vegetables found in the menu. Although all of the food groups are incorporated and important to diet quality, the menu emphasizes the servings of fruits and vegetables in Figure 2. Because of the low levels of fruits and vegetables among adult low-income population's diets, I created this menu in order to maximize the servings of fruits and vegetables incorporated within the meals. I was unsure whether I would be able to meet the fruit and vegetable recommendations by the Dietary Guidelines 2010 (USDA, 2010), so I totaled the weekly amount at the bottom of each week to ensure that even if I didn't meet the daily intake, I at least met the weekly requirements of fruits and vegetables for the total week. I achieved 141% of the recommendation for fruits and vegetables with an average of 5 1/2 cups a day during the month compared to the 4 cups per day recommended, as listed in Table 5.

This menu was created with the assumptions that the individual following this menu has the following:

- A large stock pot (8 quarts)
- A medium pan (10 inch diameter)
- Basic kitchen utensils (i.e. forks, spoons)
- Measuring cups and spoons
- Food storage containers
- Cutting boards
- A sharp knife
- Dish soap
- A refrigerator with freezer
- A conventional oven
- A stove top
- A meat thermometer
- Transportation
- Reasonable access to a fully stocked supermarket

Figure 2: Menu by Week for 3/1/2014-3/31/2014

Meal plan for the week beginning: 3/1/2014

Saturday March 01	Sunday March 02	Monday March 03	Tuesday March 04	Wednesday March 05	Thursday March 06	Friday March 07
Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
Oatmeal with Apples, Whole Wheat Toast, Hardboiled Egg, and Milk	Hardboiled Egg, Brown Rice, Pineapple, and Milk	Oatmeal with Apples, Whole Wheat Toast, and Milk	Hardboiled Egg, Brown Rice, Whole Wheat Toast, and Milk	Oatmeal with Apples, Whole Wheat Toast, and Milk	Hardboiled Egg, Brown Rice, Whole Wheat Toast, Pineapple, and Milk	Oatmeal with Apples, Whole Wheat Toast, and Milk
Vegetables:	Vegetables:	Vegetables:	Vegetables:	Vegetables:	Vegetables:	Vegetables:
Fruits: 0.75	Fruits: 0.75	Fruits: 0.75	Fruits:	Fruits: 0.75	Fruits: 0.75	Fruits: 0.75
Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
Hearty Black Bean Quesadillas, Pineapple, Carrots	Taco Chicken Bowl (2 portions)	Hearty Black Bean Quesadilla and Can of Tuna	Sweet Potato Fries, Apple, Hearty Bean Quesadilla	Greek Pizza(1/2 portion) and Tuna Apple Salad	Chili with Brown Rice	Tuna Apple Salad and Hearty Black Bean Quesadilla
Vegetables: 2.00	Vegetables: 1.50	Vegetables: 1.50	Vegetables: 3.00	Vegetables: 2.00	Vegetables: 1.50	Vegetables: 2.00
Fruits: 0.75	Fruits:	Fruits: 1.00	Fruits: 1.00	Fruits: 0.25	Fruits:	Fruits: 0.25
Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner
Taco Chicken Bowl (2 portions)	Hearty Black Bean Quesadilla (2 portions)	Chili Bowl with Brown Rice	Can of Tuna and Greek Pizza (1/2 portion)	Chili and Brown Rice	Tomato Herb Soup and Baked Chicken Breast	Spinach Tortellini Soup with Kidney Beans
Vegetables: 0.50	Vegetables: 0.50	Vegetables: 1.50	Vegetables: 2.00	Vegetables:	Vegetables: 2.00	Vegetables: 1.00
Fruits:	Fruits:	Fruits:	Fruits:	Fruits:	Fruits:	Fruits:
Snack	Snack	Snack	Snack	Snack	Snack	Snack
Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots, and Milk	Morning snack: Pineapple and Graham crackers Afternoon Snack: String Cheese and Bean and Corn Cup	Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots, and Milk	Morning snack: Pineapple and Graham crackers Afternoon Snack: String Cheese and Bean and Corn Cup	Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots, and Milk	Morning snack: Pineapple and Graham crackers Afternoon Snack: String Cheese and Bean and Corn Cup	Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots, and Milk
Vegetables: 0.50	Vegetables: 1.00	Vegetables: 0.50	Vegetables: 1.00	Vegetables: 0.50	Vegetables: 1.00	Vegetables: 0.50
Fruits: 0.75	Fruits: 0.75	Fruits: 0.75	Fruits: 0.75	Fruits: 0.75	Fruits: 0.75	Fruits: 0.75
Vegetables: 3.00	Vegetables: 3.00	Vegetables: 3.50	Vegetables: 6.00	Vegetables: 2.50	Vegetables: 4.50	Vegetables: 3.50
Fruits: 2.25	Fruits: 1.50	Fruits: 2.50	Fruits: 1.75	Fruits: 1.75	Fruits: 1.50	Fruits: 1.75
					Weekly total (cups)	Vegetables: 26.0
						Fruits: 13.00

Figure 2, continued: Menu by Week for 3/1/2014-3/31/2014

Meal plan for the week beginning: 3/8/2014

Saturday March 08	Sunday March 09	Monday March 10	Tuesday March 11	Wednesday March 12	Thursday March 13	Friday March 14
Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
Hardboiled egg, Brown Rice, Whole Wheat Toast, Banana, and Milk	Oatmeal with Apples, Whole Wheat Toast, and Milk	Hardboiled egg, Brown Rice, Banana, and Milk	Oatmeal with Apples, and Milk	Hardboiled egg, Brown Rice, Whole Wheat Toast, and Milk	Oatmeal with Apples, and Milk	Hardboiled egg, Brown Rice, Whole Wheat Toast, and Milk
Vegetables:	Vegetables:	Vegetables:	Vegetables:	Vegetables:	Vegetables:	Vegetables:
Fruits: 1.00	Fruits: 0.75	Fruits: 1.00	Fruits: 0.75	Fruits:	Fruits: 0.75	Fruits:
Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
A Can of Tuna and Peach and Coconut Rice Bowl	Mexican Lentil Stew Tuna Apple Salad	A Can of Tuna and Peach and Coconut Rice Bowl	Chicken Lime Soup (2 portions) With Brown Rice	A Can of Tuna, Beef Taco Pasta, and Banana	Spinach Tortellini Soup with Brown Rice	Taco Chicken Bowl (2 portions) and Banana
Vegetables:	Vegetables: 1.50	Vegetables:	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 0.50	Vegetables: 1.00
Fruits: 1.00	Fruits: 0.50	Fruits: 1.00	Fruits:	Fruits: 1.00	Fruits:	Fruits: 1.00
Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner
Mexican Lentil Stew and Spinach	Chicken Lime Soup and Brown Rice	Beef Taco Pasta	Spinach Tortellini Soup with beans	Mexican Lentil Stew with Hearty Black Bean Quesadilla	Tuna and Apple Salad	Italian Wonder Pot
Vegetables: 2.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 0.50	Vegetables: 3.00	Vegetables:	Vegetables: 1.00
Fruits:	Fruits:	Fruits:	Fruits:	Fruits:	Fruits: 0.50	Fruits:
Snack	Snack	Snack	Snack	Snack	Snack	Snack
Morning snack: Peaches, Graham Crackers, and Milk Afternoon Snack: String Cheese and Bean and Corn Cup	Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots	Morning snack: Peaches, Graham Crackers, and Milk Afternoon Snack: String Cheese and Bean and Corn Cup	Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots	Morning snack: Peaches, Graham Crackers, and Milk Afternoon Snack: String Cheese and Bean and Corn Cup	Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots	Morning snack: Peaches, Graham Crackers, and Milk Afternoon Snack: String Cheese and Bean and Corn Cup
Vegetables: 0.50	Vegetables: 1.00	Vegetables: 0.50	Vegetables: 1.00	Vegetables: 0.50	Vegetables: 1.00	Vegetables: 0.50
Fruits: 0.50	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50
Vegetables: 2.50	Vegetables: 3.50	Vegetables: 1.50	Vegetables: 2.50	Vegetables: 4.50	Vegetables: 1.50	Vegetables: 2.50
Fruits: 2.50	Fruits: 1.75	Fruits: 2.50	Fruits: 1.25	Fruits: 1.50	Fruits: 1.75	Fruits: 1.50
Weekly total (cups)					Vegetables:	18.50
					Fruits:	12.75

Figure 2, continued: Menu by Week for 3/1/2014-3/31/2014

Meal plan for the week beginning: 3/15/2014

Saturday March 15	Sunday March 16	Monday March 17	Tuesday March 18	Wednesday March 19	Thursday March 20	Friday March 21
Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
Hardboiled Egg, Brown Rice, Whole Wheat Toast, and Milk	Pumpkin Oatmeal with Banana, and Milk	Hardboiled Egg, Brown Rice, Whole Wheat Toast, and Milk	Pumpkin Oatmeal with Banana, and Milk	Hardboiled egg, Brown Rice, Banana, and Milk	Pumpkin Oatmeal with Banana, and Milk	Hardboiled Egg, Brown Rice, and Milk
Vegetables:	Vegetables: 1.00	Vegetables:	Vegetables: 1.00	Vegetables:	Vegetables: 1.00	Vegetables:
Fruits:	Fruits: 1.00	Fruits:	Fruits: 1.00	Fruits: 1.00	Fruits: 1.00	Fruits:
Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
Italian Wonder Pot and Peaches	Hearty Black Bean Quesadilla and Tuna Apple Salad	Garlic Noodles with Beans and Spinach, and Pineapples	Chicken Lime Soup With Brown Rice	Beef Taco Pasta and Baked Chicken Breast	Spinach Tortellini Soup with Brown Rice	Tuna Apple Salad (2 portions) Brown Rice Bowl
Vegetables: 1.00	Vegetables: 1.00	Vegetables: 2.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables:
Fruits: 0.50	Fruits: 0.50	Fruits: 1.00	Fruits:	Fruits:	Fruits:	Fruits: 1.00
Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner
Mexican Lentil Stew, Can of Tuna, and Pineapple	Baked Chicken Breast with Garlic Noodles, Beans and Spinach	Can of Tuna and Spinach Tortellini Soup	Beef Taco Pasta	Mexican Lentil Soup with Hearty Quesadilla	Chili and Rice with an Egg	Italian Wonder Pot
Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 3.00	Vegetables: 2.00	Vegetables: 1.00
Fruits: 0.50	Fruits:	Fruits:	Fruits:	Fruits:	Fruits:	Fruits:
Snack	Snack	Snack	Snack	Snack	Snack	Snack
Morning Snack: Half Banana and Graham Crackers Afternoon: String Cheese, Carrots, and Milk	Morning snack: Peaches and Crackers Afternoon Snack: String Cheese and Bean and Corn Cup	Morning Snack: Half Banana and Graham Crackers Afternoon: String Cheese, Carrots, and Milk	Morning snack: Peaches and Crackers Afternoon Snack: String Cheese and Bean and Corn Cup	Morning Snack: Half Banana and Graham Crackers Afternoon: String Cheese, Carrots, and Milk	Morning snack: Peaches and Crackers Afternoon Snack: String Cheese and Bean and Corn Cup	Morning Snack: Half Banana and Graham Crackers Afternoon: String Cheese, Carrots, and Milk
Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00
Fruits: 1.00	Fruits: 0.50	Fruits: 1.00	Fruits: 0.50	Fruits: 1.00	Fruits: 0.50	Fruits: 1.00
Vegetables: 3.00	Vegetables: 4.00	Vegetables: 4.00	Vegetables: 4.00	Vegetables: 5.00	Vegetables: 5.00	Vegetables: 2.00
Fruits: 2.00	Fruits: 2.00	Fruits: 2.00	Fruits: 1.50	Fruits: 2.00	Fruits: 1.50	Fruits: 2.00
Weekly total					Vegetables:	27.00
					Fruits:	13.00

Figure 2, continued: Menu by Week for 3/1/2014-3/31/2014

Meal plan for the week beginning: 3/22/2014

Saturday March 22	Sunday March 23	Monday March 24	Tuesday March 25	Wednesday March 26	Thursday March 27	Friday March 28
Breakfast Pumpkin Oatmeal with Apples, and Milk	Breakfast Hardboiled Egg, Brown Rice, and Milk	Breakfast Pumpkin Oatmeal with Apples, and Milk	Breakfast Hardboiled Egg, Brown Rice, Milk and Peaches	Breakfast Pumpkin Oatmeal with Banana, Whole Wheat Toast, and Milk	Breakfast Hardboiled Egg, Brown Rice, Milk and Peaches	Breakfast Pumpkin Oatmeal with Apples, and Milk
Vegetables: 1.00	Vegetables:	Vegetables: 1.00	Vegetables:	Vegetables: 1.00	Vegetables:	Vegetables: 1.00
Fruits: 0.50	Fruits:	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50
Lunch A Can of Tuna, Mexican Lentil Stew, and Banana	Lunch Greek Pizza and Tuna Apple Salad	Lunch Spinach Tortellini Soup with Kidney Beans and Banana	Lunch A Can of Tuna, Whole Wheat Toast, and Tomato Herb Soup	Lunch Tuna Apple Salad and Hearty Bean Quesadilla	Lunch Peaches and Coconut Rice Bowl	Lunch Chili with Brown Rice and Peaches
Vegetables: 2.00	Vegetables: 1.00	Vegetables: 2.00	Vegetables: 3.00	Vegetables: 1.00	Vegetables:	Vegetables: 1.00
Fruits: 1.00	Fruits: 0.50	Fruits: 1.00	Fruits:	Fruits: 0.50	Fruits: 1.00	Fruits: 1.00
Dinner Greek Pizza, Brown Rice, and Peaches	Dinner Greek Pizza and Peaches	Dinner Whole Wheat Toast, Chili, and Brown Rice	Dinner Spinach Tortellini Soup and Whole Wheat Toast	Dinner Beef Taco Pasta	Dinner Chicken Lime Soup with Spinach and Brown Rice	Dinner Taco Chicken Bowl with Whole Wheat Toast
Vegetables: 2.00	Vegetables: 2.00	Vegetables: 1.00	Vegetables: 2.00	Vegetables: 1.00	Vegetables: 2.00	Vegetables: 1.00
Fruits: 0.50	Fruits: 0.50	Fruits:	Fruits:	Fruits:	Fruits:	Fruits:
Snack Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots, and Milk	Snack Morning snack: Peaches and crackers Afternoon Snack: String Cheese and Bean and Corn Cup	Snack Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots, and Milk	Snack Morning snack: Peaches, Crackers, and Milk Afternoon Snack: String Cheese and Bean and Corn Cup	Snack Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots, and Milk	Snack Morning snack: Peaches, Crackers, and Milk Afternoon Snack: String Cheese and Bean and Corn Cup	Snack Morning Snack: Half Apple and Graham Crackers Afternoon: String Cheese, Carrots, and Milk
Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00
Fruits: 0.50	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50	Fruits: 0.50
Vegetables: 6.00	Vegetables: 4.00	Vegetables: 5.00	Vegetables: 6.00	Vegetables: 4.00	Vegetables: 3.00	Vegetables: 4.00
Fruits: 2.50	Fruits: 1.50	Fruits: 2.00	Fruits: 1.00	Fruits: 1.50	Fruits: 2.00	Fruits: 2.00
Weekly total					Vegetables:	32.00
					Fruits:	12.50

Figure 2, continued: Menu by Week for 3/1/2014-3/31/2014

Meal plan for the week beginning: 3/29/2014

Saturday March 29	Sunday March 30	Monday March 31				
Breakfast	Breakfast	Breakfast				
Pumpkin Oatmeal with Banana, and Milk	Hardboiled egg, Brown Rice, and Milk	Pumpkin Oatmeal with Apples, and Milk				
Vegetables: 1.00	Vegetables:	Vegetables: 1.00				
Fruits: 0.75	Fruits:	Fruits: 0.75				
Lunch	Lunch	Lunch				
Hearty Bean Quesadilla	Peach and Coconut Rice with a Can of Tuna	Chili and Brown Rice				
Vegetables: 2.00	Vegetables:	Vegetables: 1.00				
Fruits: 1.00	Fruits: 1.00	Fruits:				
Dinner	Dinner	Dinner				
Chicken Breast and Spinach Tortellini Soup with Brown Rice	Chicken Breast and Tomato Herb Soup	Garlic Spinach Tortellini and Beans				
Vegetables: 2.00	Vegetables: 3.00	Vegetables:				
Fruits:	Fruits:	Fruits:				
Snack	Snack	Snack				
Morning snack: Peaches and crackers Afternoon Snack: String Cheese and Bean and Corn Cup	Morning Snack: Half Banana and crackers Afternoon: String Cheese, Carrots	Morning snack: Peaches and Crackers Afternoon Snack: String Cheese and Bean and Corn Cup				
Vegetables: 1.00	Vegetables: 1.00	Vegetables: 1.00				
Fruits: 2.00	Fruits: 1.00	Fruits: 1.00				
Vegetables: 6.00	Vegetables: 4.00	Vegetables: 3.00				
Fruits: 3.75	Fruits: 2.00	Fruits: 1.75				
					Weekly total	Vegetables: 13.00
						Fruits: 7.50

Recipes

The following are the recipe ingredients I used in the main dishes for my menu, which I modified from the website *Budget Bytes* (2013). I tended to make large batches and then freeze foods for later use in meal-sized containers. In this way, I achieved both cost-savings and convenience in my food preparation tasks.

Hearty Black Bean Quesadillas

Serves: 10

Ingredients:

- 1 (15 oz.) can black beans or homemade equivalent
- 1 cup frozen corn kernels
- 1/2 yellow onion
- 1 clove garlic
- 2 cups shredded cheese
- 2 tablespoons salsa
- 10 whole grain flatbread rounds

Tomato and Herb Soup

Serves: 7 (1 cup each)

Ingredients:

- 1/4 cup canola oil
- 2 cloves garlic
- 2 tablespoons Italian seasoning
- 1 (6 oz.) can tomato paste
- 1 (28 oz.) can crushed tomatoes
- 3 cups vegetable broth or equivalent

Spinach Tortellini Soup

Serves: 8 (1 cup each)

Ingredients:

- 4 servings of Tomato and Herb Soup
- 1 (12 oz.) package frozen cheese tortellini
- 1 (10 oz.) box frozen spinach
- 2 teaspoons (or to taste) salt

Taco Chicken Bowl

Serves: 7 (1 cup each)

Ingredients:

- 1 1/2 lbs. chicken breasts
- 1 (16 oz.) jar salsa
- 1 (15 oz.) can black beans or equivalent
- 1/2 lb. frozen corn
- 1 tablespoon chili powder
- 1/2 tablespoon Italian seasoning
- 2 cups dry brown rice
- 1/2 lb. cheese

Garlic Noodles with Beans

Serves: 4 (1 1/2 cups each)

Ingredients:

- 1/2 lb. whole grain pasta
- 4 cloves minced garlic
- 2 tablespoons canola oil
- 1/4 cup cooked beans from dry or canned

Baked Pumpkin Pie Oatmeal

Serves: 8 (1 cup each)

Ingredients:

- 1 (15 oz.) can pumpkin purée
- 2 large eggs
- 1 teaspoon cinnamon
- 1/4 teaspoon nutmeg
- 1/2 teaspoon salt
- 1 1/2 cups milk
- 2 1/2 cups dry old-fashioned oats

Mexican Lentil Stew

Serves: 6 (2 cups each)

Ingredients:

- 2 cups dry red lentils
- 2 tablespoons canola oil
- 1 medium onion
- 4 cloves garlic
- 2 (14.5 oz. each) cans fire-roasted diced tomatoes
- 4 cups vegetable broth or equivalent
- 2 teaspoons chili powder
- 1 medium lime
- 1/2 cup frozen vegetable stew mix

Italian Wonder Pot

Serves: 4 (1 1/2 cups each)

Ingredients:

- 4 cups vegetable broth or equivalent
- 2 tablespoons canola oil
- 3/4 lb. whole grain pasta
- 8 oz. frozen chopped spinach
- 1 (28 oz.) can diced tomatoes
- 1 medium onion
- 4 cloves garlic
- 1 tablespoon Italian seasoning
- 2 oz. cheese
- 1/2 cup cooked beans from dry or canned

Garlic Spinach Tortellini with Beans

Serves: 4 (1 cup each)

Ingredients:

- 1/2 lb. frozen cheese tortellini
- 1 cup frozen spinach
- 4 cloves minced garlic
- 2 tablespoons canola oil
- 1/4 cup cooked beans from dry or canned

Chicken and Lime Soup

Serves: 6 (1 cup each)

Ingredients:

- 2 tablespoons canola oil
- 1 medium yellow onion
- 2 medium carrots
- 4 cloves garlic
- 3/4 lb. chicken breast
- 6 cups vegetable broth or equivalent
- 1 (14.5 oz.) can diced tomatoes w/ chilies
- 1 teaspoon Italian seasoning
- 1/2 tablespoon chili seasoning
- 1 cup frozen vegetable stew mix
- 1 medium lime

Beef Taco Pasta

Serves: 6 (1 cup each)

Ingredients:

- 1 tablespoon canola oil
- 1 small onion
- 3/4 lb. lean ground beef
- 1 tablespoon chili powder
- 1 (15 oz.) can diced tomatoes
- 2 cups vegetable broth or equivalent
- 1/2 lb. whole grain pasta
- 1 cup shredded cheese

Basic Chili

Serves: 6 (1 cup each)

Ingredients:

- 2 tablespoons canola oil
- 1 yellow onion
- 2 cloves garlic
- 1 lb. ground beef
- 1 (15 oz.) can kidney beans
- 1 (15 oz.) can black beans
- 1 (15 oz.) can diced tomatoes
- 1 (6 oz.) can tomato paste
- 1 cup water
- 2 tablespoons chili powder

Greek Pizza

Serves: 4 (Cut into quarters)

Ingredients

- 3 flatbreads, 100% whole grain
- 2 tablespoons canola oil
- 1 teaspoon Italian seasoning
- 2 cups spinach, cooked (fresh or frozen)
- 1 cup shredded mozzarella cheese
- 1 onion, caramelized
- 1/2 bulb roasted garlic
- 1/2 can or 7 oz. artichoke hearts

Shopping Costs

For this menu, I shopped exclusively at the fully stocked grocery store Dillons in Manhattan, Ks. Table 6 gives a breakdown of the costs per food group for the entire month. At the end of the month, I had leftover partial packages of food such as frozen spinach, graham crackers, and canned tomatoes. I also had left over condiments and spices that would carry over to the next month and improve my shopping budget for April.

In order to meet the Dietary Guidelines 2010 (USDA, 2010), I found that I needed to focus the majority of my budget on fruits and vegetables. As previously stated, Cassady et al. (2007) found that families would have to allocate 43% to 70% of their total monthly budget on fruits and vegetables in order to meet the Dietary Guidelines 2005. In order to meet the most recent Dietary Guidelines, I had to allocate a total of 37% of my budget towards fruits and vegetables alone. The next food groups that took the largest part of my budget were dairy at 21%, followed by animal protein at 19%. Spices and condiments took up a relatively large portion of my budget, 7%, considering their main purpose was to enhance sensory properties and not nutritional status. However, this 7% of my budget spent on spices and condiments would not appear in next month's budget because I would not have to buy them again until they run out; therefore freeing up 7% of my budget to allocate towards more nutritious foods next month.

To save money, I cut some flavor enhancing ingredients from recipes and replaced them with the spices I already bought, such as replacing jalapenos with chili seasoning. I also reduced my costs by opting for seemingly more expensive block cheese rather than shredded cheese for my ingredients because shredded cheese bags only had 1 1/2 to 2 cups of shredded cheese as opposed to a 24 oz block of cheese that yielded on average 3 cups of shredded cheese. Another way I saved cost and avoided excess sodium intake was replacing canned or boxed broth with bouillon cubes. The canned or boxed broth I found at the store had an average of 800mg sodium per cup of broth, and the reduced sodium broth had 400mg sodium per cup. Since broth was a prevalent ingredient in my dishes, I opted for vegetable bouillon cubes to control how much sodium was in the dishes at 200mg per cup. In this way, I spent \$2.49 on a small box of bouillon cubes that would make the equivalent of 16 cups of broth. Although these changes required more

effort to complete the dishes, they were cost effective and gave me more funds within my budget.

Since I only spent 88% of my total budget, I would take the leftover money and build on what I already have in my pantry to enhance sensory properties of my dishes and reduce food insufficiency by buying foods with a longer shelf-life. First, I would improve my pantry with a variety of spices and condiments. Although these don't provide significant nutritional benefits, having to modify my recipes to accommodate my budget made some of my dishes, such as the Chicken and Lime Soup, pretty bland. Since spices can be found for a dollar each bottle, I would slowly build on variety to improve the taste of my dishes. Another way I would allocate my leftover funds would be to buy canned fruits and vegetables as a backup for busy days when I can't make it to the store or have the time to cook. This way, I would work towards having a pantry that is always full and leaves funds for me to buy more variety of fresh foods without worrying how long they will last. I believe that if I were able to build a pantry that eliminated feelings of food insufficiency, I would be more willing to spend money towards a larger variety of foods as well as simple pleasures such as coffee.

Table 6: Total Cost of Foods, per Food Groups, for the March 2014 Menu

Fruit	Cost	Vegetables	Cost
Limes	\$1.00	Frozen Sweet Potato Fries	\$4.38
Bananas	\$3.00	Frozen Corn	\$2.99
Canned Peaches	\$10.50	Frozen Vegetable Stew Mix	\$2.99
Golden Apples	\$5.95	Frozen Chopped Spinach	\$2.99
Canned Pineapple	\$3.00	Jarred Artichoke Hearts	\$1.93
<i>Total:</i>	\$23.45	Canned Pumpkin	\$1.78
<i>% of Total Budget:</i>	13.6%	Canned Tomato Sauce	\$2.69
		Canned Tomato Paste	\$0.98
		Canned Crushed Tomatoes	\$2.47
Dairy	Cost	All Canned Diced Tomatoes	\$3.18
All Block Cheese	\$11.98	Canned Black Beans	\$2.40
String Cheese	\$9.58	Canned Kidney Beans	\$0.69
Cheese Tortellini	\$2.99	Dried Kidney Beans	\$1.79
Milk	\$11.12	Dried Black Beans	\$1.39
<i>Total:</i>	\$35.67	Lentils	\$1.79
<i>% of Total Budget:</i>	20.7%	Carrots	\$1.36
		Yellow Onion	\$2.28
Spices/Condiments	Cost	Garlic	\$1.77
Chili Powder	\$2.19	Potato	\$1.00
Cinnamon	\$1.00		
Iodized Salt	\$0.47	<i>Total:</i>	\$40.85
Italian Seasoning	\$1.00	<i>% of Total Budget:</i>	23.8%
Nutmeg	\$1.00		
Salsa	\$1.67	Animal Protein	Cost
Vegetable Bouillon Cubes	\$2.49	Lean Ground Beef	\$9.98
Mayonnaise	\$2.97	Chicken Breast	\$13.98
<i>Total:</i>	\$12.79	Eggs	\$2.88
<i>% of Total Budget:</i>	7.4%	Tuna	\$6.32
		<i>Total:</i>	\$33.16
Grains	Cost	<i>% of Total Budget</i>	19.2%
Graham Crackers	\$2.50		
Old Fashioned Oats	\$3.29	Fats	Cost
Whole Grain Flat Bread	\$4.99	Canola Oil	\$2.99
Brown Rice	\$3.00	Coconut Milk	\$3.40
Whole Grain Pasta	\$2.19	<i>Total:</i>	6.39
Whole Grain Bread	\$2.99	<i>% of Total Budget:</i>	3.7%
<i>Total:</i>	\$19.96		
<i>% of Total Budget:</i>	11.6%	Total:	\$171.87
		<i>% of Total Budget</i>	88.2%

USDA Dietary Guidelines Breakdown

With the use of the USDA's *SuperTracker* food processing software (USDA, 2014), I broke down the nutritional quality by week for the menu. Because the Thrifty Food Plan's budget is limited, I aimed for my menu to meet at least the "OK" status for each food group. Table 7 shows the four reports from *SuperTracker*'s analysis of my menu for the month of March. The software allowed for me to include the final 3 days of March into a week for an average report for those last 10 days.

There were quite a few problems with *SuperTracker* (USDA, 2014) in reflecting the actual dietary quality of my menu. For instance, it did not allow me to change my calorie allowance to the appropriate 1800 kcal recommended for my age and height, so Table 7 reflects a 2000 kcal diet. Also, Table 7 shows that I did not eat enough beans in the vegetable category because *SuperTracker* wouldn't allocate beans to both protein and vegetable intake. Instead, I had to manually list my bean intake as protein foods that took away their vegetable qualification according to the software. Also, some of my bean intake was categorized automatically into the "nuts, seeds, and soy" category. Overall, my actual intake of fruits and vegetable intake was very high at about 40 cups per week, but this amount was not reflected in the food group reports which showed that I consumed about 33 cups per week. This was because I counted my bean intake as contributing to my fruits and vegetables consumption and as part of my protein foods consumption. Also, I could not manually enter my whole grain intake from special foods, such as the whole grain flat breads, causing my reports to show a small intake of whole grains compared to refined grains. Finally, my empty calories mainly came from cheese, reduced fat (2%) milk, eggs, and graham crackers at 20%, 17%, 13%, and 11% of empty calorie intake, respectively.

Table 7: Menu Analysis by Food Groups and Calories, 3/1/2014 to 3/31/2014 (USDA, 2014)

Maryann's Food Groups and Calories Report 03/01/14 - 03/07/14

Your plan is based on a 2000 Calorie allowance.

Food Groups	Target	Average Eaten	Status
Grains	6 ounce(s)	6½ ounce(s)	OK
Whole Grains	≥ 3 ounce(s)	4 ounce(s)	OK
Refined Grains	≤ 3 ounce(s)	2½ ounce(s)	OK
Vegetables	2½ cup(s)	3½ cup(s)	Over
Dark Green	1½ cup(s)/week	¼ cup(s)	Under
Red & Orange	5½ cup(s)/week	6¼ cup(s)	Over
Beans & Peas	1½ cup(s)/week	1¾ cup(s)	OK
Starchy	5 cup(s)/week	1½ cup(s)	Under
Other	4 cup(s)/week	1 cup(s)	Under
Fruits	2 cup(s)	2 cup(s)	OK
Whole Fruit	No Specific Target	2 cup(s)	No Specific Target
Fruit Juice	No Specific Target	0 cup(s)	No Specific Target
Dairy	3 cup(s)	3½ cup(s)	Over
Milk & Yogurt	No Specific Target	1¾ cup(s)	No Specific Target
Cheese	No Specific Target	1¾ cup(s)	No Specific Target
Protein Foods	5½ ounce(s)	6½ ounce(s)	Over
Seafood	8 ounce(s)/week	7½ ounce(s)	OK
Meat, Poultry & Eggs	No Specific Target	3 ounce(s)	No Specific Target
Nuts, Seeds & Soy	No Specific Target	1 ounce(s)	No Specific Target
Oils	6 teaspoon	3 teaspoon	Under
Limits	Allowance	Average Eaten	Status
Total Calories	2000 Calories	1838 Calories	OK
Empty Calories*	≤ 258 Calories	246 Calories	OK
Solid Fats	*	219 Calories	*
Added Sugars	*	27 Calories	*

Table 7, continued: Menu Analysis by Food Groups and Calories, 3/1/2014 to 3/31/2014 (USDA, 2014)

Maryann's Food Groups and Calories Report 03/08/14 - 03/14/14

Your plan is based on a **2000 Calorie** allowance.

Food Groups	Target	Average Eaten	Status
Grains	6 ounce(s)	6 ounce(s)	OK
Whole Grains	≥ 3 ounce(s)	5½ ounce(s)	OK
Refined Grains	≤ 3 ounce(s)	1 ounce(s)	OK
Vegetables	2½ cup(s)	2¾ cup(s)	OK
Dark Green	1½ cup(s)/week	1¼ cup(s)	OK
Red & Orange	5½ cup(s)/week	5 cup(s)	Under
Beans & Peas	1½ cup(s)/week	0 cup(s)	Under
Starchy	5 cup(s)/week	1 cup(s)	Under
Other	4 cup(s)/week	¾ cup(s)	Under
Fruits	2 cup(s)	1¾ cup(s)	OK
Whole Fruit	No Specific Target	1¾ cup(s)	No Specific Target
Fruit Juice	No Specific Target	0 cup(s)	No Specific Target
Dairy	3 cup(s)	2¾ cup(s)	OK
Milk & Yogurt	No Specific Target	1¾ cup(s)	No Specific Target
Cheese	No Specific Target	1 cup(s)	No Specific Target
Protein Foods	5½ ounce(s)	6 ounce(s)	OK
Seafood	8 ounce(s)/week	9 ounce(s)	Over
Meat, Poultry & Eggs	No Specific Target	2½ ounce(s)	No Specific Target
Nuts, Seeds & Soy	No Specific Target	1 ounce(s)	No Specific Target
Oils	6 teaspoon	2 teaspoon	Under
Limits	Allowance	Average Eaten	Status
Total Calories	2000 Calories	1690 Calories	Under
Empty Calories*	≤ 258 Calories	227 Calories	OK
Solid Fats	*	163 Calories	*
Added Sugars	*	63 Calories	*

Table 7, continued: Menu Analysis by Food Groups and Calories, 3/1/2014 to 3/31/2014 (USDA, 2014)

Maryann's Food Groups and Calories Report 03/15/14 - 03/21/14

Your plan is based on a **2000 Calorie** allowance.

Food Groups	Target	Average Eaten	Status
Grains	6 ounce(s)	6½ ounce(s)	OK
Whole Grains	≥ 3 ounce(s)	5 ounce(s)	OK
Refined Grains	≤ 3 ounce(s)	1 ounce(s)	OK
Vegetables	2½ cup(s)	2½ cup(s)	OK
Dark Green	1½ cup(s)/week	1¼ cup(s)	OK
Red & Orange	5½ cup(s)/week	5¼ cup(s)	OK
Beans & Peas	1½ cup(s)/week	¼ cup(s)	Under
Starchy	5 cup(s)/week	1 cup(s)	Under
Other	4 cup(s)/week	½ cup(s)	Under
Fruits	2 cup(s)	1¾ cup(s)	OK
Whole Fruit	No Specific Target	1¾ cup(s)	No Specific Target
Fruit Juice	No Specific Target	0 cup(s)	No Specific Target
Dairy	3 cup(s)	3¼ cup(s)	OK
Milk & Yogurt	No Specific Target	2 cup(s)	No Specific Target
Cheese	No Specific Target	1 cup(s)	No Specific Target
Protein Foods	5½ ounce(s)	6 ounce(s)	OK
Seafood	8 ounce(s)/week	8½ ounce(s)	OK
Meat, Poultry & Eggs	No Specific Target	2½ ounce(s)	No Specific Target
Nuts, Seeds & Soy	No Specific Target	1 ounce(s)	No Specific Target
Oils	6 teaspoon	2 teaspoon	Under
Limits	Allowance	Average Eaten	Status
Total Calories	2000 Calories	1776 Calories	OK
Empty Calories*	≤ 258 Calories	209 Calories	OK
Solid Fats	*	183 Calories	*
Added Sugars	*	26 Calories	*

Table 7, continued: Menu Analysis by Food Groups and Calories, 3/1/2014 to 3/31/2014 (USDA, 2014)

Maryann's Food Groups and Calories Report 03/22/14 - 03/31/14

Your plan is based on a 2000 Calorie allowance.

Food Groups	Target	Average Eaten	Status
Grains	6 ounce(s)	5½ ounce(s)	OK
Whole Grains	≥ 3 ounce(s)	4 ounce(s)	OK
Refined Grains	≤ 3 ounce(s)	1½ ounce(s)	OK
Vegetables	2½ cup(s)	2½ cup(s)	OK
Dark Green	1½ cup(s)/week	1¼ cup(s)	OK
Red & Orange	5½ cup(s)/week	4½ cup(s)	Under
Beans & Peas	1½ cup(s)/week	¾ cup(s)	Under
Starchy	5 cup(s)/week	1 cup(s)	Under
Other	4 cup(s)/week	½ cup(s)	Under
Fruits	2 cup(s)	2 cup(s)	OK
Whole Fruit	No Specific Target	2 cup(s)	No Specific Target
Fruit Juice	No Specific Target	0 cup(s)	No Specific Target
Dairy	3 cup(s)	3 cup(s)	OK
Milk & Yogurt	No Specific Target	1¾ cup(s)	No Specific Target
Cheese	No Specific Target	1¼ cup(s)	No Specific Target
Protein Foods	5½ ounce(s)	5½ ounce(s)	OK
Seafood	8 ounce(s)/week	6 ounce(s)	Under
Meat, Poultry & Eggs	No Specific Target	2½ ounce(s)	No Specific Target
Nuts, Seeds & Soy	No Specific Target	1 ounce(s)	No Specific Target
Oils	6 teaspoon	3 teaspoon	Under
Limits	Allowance	Average Eaten	Status
Total Calories	2000 Calories	1739 Calories	OK
Empty Calories*	≤ 258 Calories	228 Calories	OK
Solid Fats	*	183 Calories	*
Added Sugars	*	45 Calories	*

Personal Reflections

Attempting to meet the Dietary Guidelines has always been a concern for my daily diet intake, but budgeting has not been something that I have been overly concerned about to meet this task. Being confined to about \$194 for one month didn't seem as though it would be an overly difficult task initially, but accounting for the amount of fruits and vegetables I needed to consume in order to meet the guidelines within this budget, it was a daunting task. I heavily relied on the blog *Budget Bytes* (2013) in order to create a practical menu through shopping and cooking practices such as freezing and comparing cost and convenience from frozen, canned, and fresh sections of the store. Also, foods that scored high on the ANI scale created by Drewnowski (2013) gave me a reference for what kinds of recipes to look for and which other foods to feature in my meals, in order to create a cost-effective and nutritious menu. I also used a list of nutrient dense and cost effective foods by Stewart et al. (2011) to determine which fruits and vegetables would yield the most nutrients for their cost.

When I was shopping for this menu, I became very aware of the advantages I had within my food environment that many low-income populations across the U.S. do not have. For instance, I shopped exclusively at a fully stocked supermarket that was only a five-minute drive from my home. Other than some fresh produce being out of season, I didn't have to worry about the foods that I wanted to buy not being stocked at this grocery store. Not only was I close to the supermarket, but also I had private transportation. I was able to load into my car more than what I could have carried home. If I were to make my purchases all at once for the month, as low-income populations report doing, there would be no feasible way for me to carry my groceries home by walking, riding my bicycle, or using public transportation. Also, this supermarket participates in WIC, and their clearly labeled shelf signs for WIC-approved foods directed me to the most cost-effective, nutrient-dense foods in the store. Finally, because of my studies, I also had the benefit of existing knowledge of healthful foods as well as a clear understanding of the Nutrition Facts, ingredients lists, and other information labels on the packaging.

My menu for the month of March is repetitive, which was ideal to fit my busy lifestyle and to consistently meet my own personal preferences. Meeting the Dietary Guidelines was easiest for me when I incorporated vegetables within my main dishes rather than as a side dish,

because of palatability and convenience. I found that I repeated those foods that were delicious and convenient, such as the Hearty Bean Quesadilla, frequently. I added variety within the menu, such as by mixing dishes together or by substituting parts of meals as snacks.

Overall, I found little difficulty incorporating whole-grains, healthful protein options, vegetables, and dairy. However, I had a difficult time assuring that fruits were adequately represented within the menu. The meals were filling, which meant that I made it a conscious effort to snack on fruits between meals.

Also, as I incorporated nutrient-dense foods such as tomato-based products, the sodium content of the menu increased. Reduced-sodium products were always more expensive, so I made the conscious decision to buy the typical products, regardless of their sodium content, because of the high ANI scores. Ideally, I would have benefited from having the purchasing power to buy lower-sodium products.

To my surprise, I was able to stay under budget and still meet the Dietary Guidelines for the food groups, according to analyses using *SuperTracker* (USDA, 2014). I used *SuperTracker* because it is a free food processing software that people can access with a basic Internet connection. *SuperTracker* made it relatively simple to add recipes that I used throughout the month, and provided helpful reports on food groups and trends in my diet. However, having to manually enter plant protein, such as beans, as a protein food group diminished the user friendliness of *SuperTracker*. I only noticed that my beans weren't being counted towards my protein food group after weeks of entering data. I dedicated much time going back to manually check each time that I incorporated beans into my diet, in order to be sure that they were counted in the protein group, as I intended them to be my protein source for the meal, instead of as a vegetable. According to the Dietary Guidelines 2010, beans provide the benefits of both a protein food and vegetable, and I believe that *SuperTracker* should recognize that within the software to give an accurate report.

Staying under budget this month gave me extra money for my budget to apply towards next month's groceries. Low-income individuals could use this extra money to apply towards

other budgets within their household, but they could also benefit from applying this money as an investment in their nutrition quality. These extra funds could be applied to purchasing staple foods that are readily available, such as canned beans, canned fruits, and frozen vegetables, in order to keep the pantry at home full and avoid food insufficiency. Also, there were leftover products from this month that can be carried over to next month. For instance, I would not have to buy canola oil, spices, mayonnaise, or as many dried beans in the month of April 2014 because these foods will carry over. This way, I have more money to spend on nutrient-dense foods instead of spending on condiments. Building on what foods are already available and cooked beforehand creates a sustainable management of foods within the household. These practices can prevent the fear and anxiety associated with having a completely empty refrigerator, freezer, or pantry in the home.

This Thrifty Food Plan/Dietary Guidelines 2010 menu is not one that can be generalized for use across populations that struggle with food insecurity in the U.S., mainly because most of these groups lack access to a fully stocked supermarket and/or to transportation. While implementing this menu during March 2014, I did not budget my money to feed family and friends that may have visited nor had a history of hunger that would have resulted in binge eating during the first part of the month. My success in implementing this menu was in part because I benefited from shopping at a WIC-authorized store that was close enough to my home that I could drive to it more than once during the month to restock my pantry. Future projects assessing whether or not Americans can meet the Dietary Guidelines using non-fully stocked markets or convenience stores would give a clearer picture of the struggles that many people living in the U.S. face in meeting the Dietary Guidelines 2010 on low incomes. I could only imagine having to carry the heavy items on my menu, such as gallons of milk and canned food items, on a walk home or while using public transportation.

I designed this menu with the intention of staying within the Thrifty Food Plan's grocery budget, and I was able to successfully implement it. However, I am not fully convinced by my experiences with this menu that adults across the U.S. can meet the Dietary Guidelines 2010 on the Thrifty Food Plan budget. Nutrition professionals would benefit from an in-depth

understanding of the complexity of the struggles that low-income populations in the U.S. face in acquiring adequate nutrition.

Gaps in Research

When writing this report, I attempted to have the most comprehensive approach to dietary quality among at-risk populations to the best of my ability. However, there were several gaps in research that I hope to be addressed by future researchers in this field that include old data, reliance on cross-sectional studies, single dimensional focus on food group excesses, and sole accountability on the individual for his or her food choices. I hoped to have the most up-to-date information on this subject, but I found that the literature was not relevant to today's discussion because of the constantly changing environment around the topic of dietary quality. In order to approach the subject of suboptimal dietary quality among at-risk populations, scientists need to find a multisystemic approach to improving dietary quality.

As policies that alleviate food insecurity and improve dietary quality constantly change, I found it difficult to find an up-to-date comprehensive approach to low-income dietary quality. For instance, most of the literature I reviewed on this subject presented within this report was published post-2010, but the data collected relied heavily on NHANES data from 2003-04. Although this gives a keen insight to what the diets of low-income populations look like with a broad perspective, it does not show what diets look like currently and what specifically affects their diet choices. The most insightful sources that I used for this report came from qualitative research and control studies. Although these sources were very helpful to this report and could be generalized for other populations, they were mainly focused around populations in Minnesota.

Another common difficulty for this report was the lack of data on specific food group needs within the low-income population. There was an overwhelming focus on what low-income populations exceed such as added fats and sugars, but it was difficult to find literature about their food group consumption. As stated before, the research regarding dietary patterns came from NHANES data from 2004. Although these data are helpful, they are not relevant to today's discussion of dietary quality because of the influence that environmental factors, such as food costs and policy change, have on dietary intake quality. Because low-income populations are at risk for diet-related diseases, future studies need to address this population specifically in order to determine not only the excesses, but the state of intake of all food groups set by the current and future USDA Dietary Guidelines.

Conclusion

A multisystemic approach is necessary for positive change within this population. Low-income populations are at-risk of developing diet-related diseases such as type 2 diabetes, cardiovascular disease, obesity, and hypertension. This population faces a poor diet intake quality because of personal preferences, food environments, living conditions, policy changes, and food costs. Since overwhelming data show that this population is unaware of the Dietary Guidelines, healthcare professionals must assure that this information reaches at-risk populations. One approach alone does not guarantee success in dietary intake quality among this population, as shown by several studies that focused solely on interventions surrounding distribution, education, and emergency food assistance. The most effective interventions within this population addressed several interventions, such as those that addressed food insecurity because of transportation issues by delivering assistance to people living in food deserts. This population benefits from health care professionals who give education, enroll eligible clients in nutrition assistance programs, aid in budgeting, aid in planning menus, incorporate preferences, and understand the barriers within the surrounding food environment.

References

- Aggarwal A, Monsivais P, Cook AJ, et al. Does diet cost mediate the relation between socioeconomic position and diet quality? *Eur J Clin Nutr* 2011;65:1059–1066
- Akobundu UO, Cohen NL, Laus MJ, et al. Vitamins A and C, calcium, fruit, and dairy products are limited in food pantries. *J Am Diet Assoc* 2004;104:811-813
- Andreyeva T, Long MW, & Brownell KD. The impact of food prices on consumption: a systematic review of research on the price elasticity of demand for food. *Am J Pub Health* 2010;100:216–222
- Au L, Rogers G, Harris S, et al. Associations of vitamin D intake with 25-hydroxyvitamin D in overweight and racially/ethnically diverse U.S. children. *J Acad Nutr Diet* 2013;113:1511-1516
- Bartfeld J & Ahn H. The school breakfast program strengthens household food security among low-income households with elementary school children. *J of Nutr* 2011;141:470-475
- Baumler MD, Hasan D, & Stark LK. Fiber, whole grains, fruits, and dairy are deficient at food pantries. *J Acad Nutr Diet* 2013;113:A-11
- Beydoun MA & Wang Y. How do socio-economic status, perceived economic barriers and nutritional benefits affect quality of dietary intake among U.S. adults? *Eur J Clin Nutr* 2008;62:303-313
- Binkley J. Low income and poor health choices: The example of smoking. *Am J Agric Econ* 2009;92(4):972-984
- Bittman M. (2011, Sept. 25) Is junk food really cheaper? *The New York Times* Sept 2011: SR1
- Britten P, Cleveland L, Koegel K, et al. Impact of typical rather than nutrient-dense food choices in the U.S. Department of Agriculture food patterns. *J Acad Nutr Diet* 2012;112:1560-1569
- Budget Bytes. (2013). Available at: <http://www.budgetbytes.com> Accessed February 14, 2014.
- Bureau of Labor & Statistics, U.S. Department of Labor. (2014). Inflation and prices: Top picks of average price data. Postal Square Building, 2 Massachusetts Avenue, NE Washington, DC Available at: <http://data.bls.gov/cgi-bin/surveymost> Accessed January 22, 2014
- Carlson, A, Lino, M, Juan, W-Y, et al. (2007). Thrifty Food Plan, 2006. (CNPP-19). U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. Available at: <http://www.cnpp.usda.gov/Publications/FoodPlans/MiscPubs/TFP2006Report.pdf> Accessed April 10, 2014
- Cassady D, Jetter KM, & Culp J. Is price a barrier to eating more fruits and vegetables for low-income families? *J Am Diet Assoc* 2007;107:1909–1915
- Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2004. Available at: <http://www.cdc.gov/nchs/nhanes.htm> Accessed February 10, 2014

- Coleman-Jensen A, Nord M, & Singh A. Household food security in the United States in 2012, ERR-155, U.S. Department of Agriculture, Economic Research Service, September 2013. Available at: http://www.ers.usda.gov/publications/err-economic-research-report/err155.aspx#.U0iQMceR_Wo Accessed April 10, 2014
- Cotugna N. Food pantries in schools help alleviate childhood hunger. *J Acad Nutr Diet* 2012;112:A-82
- Cotugna N, Wolfe R, & Manning CK. Food closets in state service centers assist with emergency food delivery. *J Acad Nutr Diet* 2012;112:A-82
- Couch SC, Zhou C, Glanz K, et al. Home food environment associations with children's dietary intake and weight status. *J Acad Nutr Diet* 2013;113:A-27
- Cullen K, Baranowski T, Watson K, et al. Food category purchases vary by household education and race: Results from grocery receipts. *J Am Diet Assoc* 2007;107:1747-1752
- Dammann K & Smith C. Factors affecting low-income women women's food choices and the perceived impact of dietary intake and socioeconomic status on their health and weight. *J Nutr Educ Behav* 2009;41:242-253
- Dammann K & Smith C. Race, homelessness, and other environmental factors associated with the food-purchasing behavior of low-income women. *J Acad Nutr Diet* 2010;110:1351-1356
- Davis A, Befort C, Steiger K, et al. The nutrition needs of low-income families regarding living healthier lifestyles: findings from a qualitative study. *J Child Health Care* 2013;17:53-61
- Dinour L, Bergen D, Yeh M, et al. The food insecurity—obesity paradox: a review of the literature and the role food stamps may play. *J Am Diet Assoc* 2007;107:1952-1961
- Dressler H & Smith C. Food choice, eating behavior, and food liking differs between lean/normal and overweight/obese, low-income women. *Appetite* 2013;65:145-152
- Drewnowski A. New metrics of affordable nutrition: Which vegetables provide most nutrients for least cost? *J Acad Nutr Diet* 2013;113:1182-1187
- Eikenberry N & Smith C. Healthful eating: Perceptions, motivations, barriers, and promoters in low-income Minnesota communities. *J Am Diet Assoc* 2004;104:1158-1161
- Evans EW, Hayes C, Palmer C, et al. Dietary intake and severe early childhood caries in low-income, young children. *J Acad Nutr Diet* 2013;113:1057-1061
- Federal Register. (2014). Annual update of HHS poverty guidelines. Available at: <https://www.federalregister.gov/articles/2014/01/22/2014-01303/annual-update-of-the-hhs-poverty-guidelines> Accessed April 24, 2014
- Food Research & Action Center. (2014). SNAP/Food stamp participation. Available at: <http://frac.org/reports-and-resources/snapfood-stamp-monthly-participation-data/> Accessed February 14, 2014
- Ford C, Slining M, & Popkin B. Trends in Dietary Intake among U.S. 2- to 6-year-old children, 1989-2008. *J Acad Nutr Diet* 2013;113:35-42
- Fowles E, Stang J, Bryant M et al. Stress, depression, social support, and eating habits reduce diet quality in the first trimester in low-income women: A pilot study. *J Acad Nutr Diet* 2012;112:1619-1625

- Frazao E, Andrews M, Smallwood D, et al. Can food stamps do more to improve food choices? An economic perspective—food spending patterns of low-income households: Will increasing purchasing power result in healthier food choices? Economic Information Bulletin Number 29-4. U.S. Department of Agriculture, Economic Research Service, September 2007. Available at: http://www.ers.usda.gov/ersDownloadHandler.ashx?file=/media/1155888/eib29-4pdf0%C8%BCr_tq-.pdf Accessed January 22, 2014
- Gibson D. Long-term food stamp program participation is positively related to simultaneous overweight in young daughters and obesity in mothers. *J of Nutr* 2006;136:1081-1085
- Giskes K, Van Lenthe F, Brug J, et al. Socioeconomic inequalities in food purchasing: The contribution of respondent-perceived and actual (objectively measured) price and availability of foods. *Prev Med* 2007;45:41-48
- Graham D, Pelletier J, Neumark-Sztainer D, et al. Perceived social-ecological factors associated with fruit and vegetable purchasing, preparation, and consumption among young adults. *J Acad Nutr Diet* 2013;113:1366-1374
- Hendrickson D, Smith C, & Eikenberry N. Fruit and vegetable access in four low-income food deserts communities in Minnesota. *Agric Hum Values* 2006;23:371-383
- Hiza H, Casavale K, Guenther P, et al. Diet quality of Americans differs by age, sex, race/ethnicity, income, and education level. *J Acad Nutr Diet* 2013;113:297-306
- Hoerr SL, Tsuei E, Liu Y, et al. Diet quality varies by race of Head Start mothers. *J Am Diet Assoc* 2008;108:651-659
- Hughes C, Sherman S, & Whitaker R. How low-income mothers with overweight preschool children make sense of obesity. *Qual Health Res* 2010;20(4):465-478
- Inglis V, Ball K, & Crawford D. Does modifying the household food budget predict changes in the healthfulness of purchasing choices among low- and high-income women? *Appetite* 2009;52:273-279
- Jetter K & Cassady D. The availability and cost of healthier food alternatives. *Am J Prev Med* 2006;30(1):38-44
- Katz DL, Doughty K, Njike V, et al. A cost comparison of more and less nutritious food choices in U.S. supermarkets. *Pub Health Nutr* 2011;14:1693-1699
- Kirkpatrick S, Dodd K, Reedy J, et al. Income and race/ethnicity are associated with adherence to food-based dietary guidance among U.S. adults and children. *J Acad Nutr Diet* 2012;112:624-635
- Kuhls J, Habash D, Clutter J, et al. The ideal food pantry as designed by food pantry customers. *J Acad Nutr Diet* 2012;112:A-78
- Kusovitsky L, Tellerman R, Valenzuela R, et al. Urban farming and the New York City emergency food system. *J Acad Nutr Diet* 2012;112:A-89
- Larson N, Bruening M, MacLehose R, et al. Household food insecurity: Links to adolescent eating patterns and weight status. *J Acad Nutr Diet* 2012;112:A-90

- Laster L, Lovelady C, West D, et al. Diet quality of overweight and obese mothers and their preschool children. *J Acad Nutr Diet* 2013;113:1476-1483
- Leung C, Hoffnagle E, Lindsay A, et al. A qualitative study of diverse experts' views about barriers and strategies to improve the diets and health of Supplemental Nutrition Assistance Program (SNAP) beneficiaries. *J Acad Nutr Diet* 2013;113:70-76
- Leung C, Willett W, & Ding E. Low-income Supplemental Nutrition Assistance Program participation is related to adiposity and metabolic risk factors. *Am J Clin Nutr* 2012;95:17-24
- Lipsky LM. Are energy-dense foods really cheaper? Reexamining the relation between food price and energy density. *Am J Clin Nutr* 2009;90:1397-1401
- Lohse B, Bailey R, Krall J, et al. Diet quality is related to eating competence in cross-sectional sample of low-income females surveyed in Pennsylvania. *Appetite* 2012;58:645-650
- Lu W, Chen X, Miao J, et al. Examining the disparities in children's healthy eating by parents' socio-demographic characteristics in rural Texas. *J Acad Nutr Diet* 2013;113:A-82
- Malhotra K, Herman A, Wright G, et al. Perceived benefits and challenges for low-income mothers having family meals with preschool-aged children: Childhood memories matter. *J Acad Nutr Diet* 2013;113:1484-1493
- Martin-Biggers J, Aljallad C, Ciercierski C, et al. U.S. supermarket sale circulars: Which food groups do they promote the most? *J Acad Nutr Diet* 2012;112:A-57
- Masters M, Stanek-Krogstrand K, & Albrecht JA. Associations between characteristics of the family food environment and food availability in homes of U.S. youth, aged 6-19. *J Acad Nutr Diet* 2012;112:A-94
- McCarthy HN, Cho E, Jackson JK, et al. Barriers to utilization of the Supplemental Nutrition Assistance Program (CalFresh) in Los Angeles county. *J Acad Nutr Diet* 2012;112:A-91
- Monsivais P & Drewnowski A. Lower energy-density diets are associated with higher monetary costs per kilocalorie and are consumed by women of higher socioeconomic status. *J Am Diet Assoc* 2009;109:814-822
- Moore CE, Radcliffe J, & Liu Y. Vitamin D intakes of children differ by income and race/ethnicity in the United States, 2007-2010. *J Acad Nutr Diet* 2013;113:A-85
- Neal R, Hudson H, Plante M, et al. CNY Health Bucks: Connecting low-income households to local fruits and vegetables. *J Acad Nutr Diet* 2012;112:A-77
- Noia J & Byrd-Bredbenner C. Adolescent fruit and vegetable intake: Influence of family support and moderation by home availability of relationships with afrocentric values and taste preferences. *J Acad Nutr Diet* 2013;113:803-808
- Nord M & Parker L. How adequately are food needs of children in low-income households being met? *Child Youth Serv Rev* 2010;32:1175-1185
- Poole A, Ruiz CS, Shows AR, et al. Household food security status, food perceptions, dietary behaviors and weight status in Southeast Texas residents. *J Acad Nutr Diet* 2013;113:A-94
- Powell L, Chaloupka F, & Bao Y. The availability of fast-food and full-service restaurants in the United States. *Am J Prev Med* 2007;33(4S):S240-S245

- Rao M, Afshin A, Singh G, et al. Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis. *BMJ Open* 2013;3:e004277. doi:10.1136/bmjopen-2013-004277
- Reyes N, Klotz A, & Herring S. A qualitative study of motivators and barriers to healthy eating in pregnancy for low-income, overweight, African-American mothers. *J Acad Nutr Diet* 2013;113:1175-1181
- Richards R & Smith C. Environmental, parental, and personal influences on food choice, access, and overweight status among homeless children. *Soc Sci & Med* 2007;65:1572-1583
- Scientific American. (2012). For a healthier country, overhaul farm subsidies. 19 April 2012. [Editorial]. Available at: <http://www.scientificamerican.com/article/fresh-fruit-hold-the-insulin/> Accessed July 5, 2012
- Seman LM, Compton L, & Musiker M. It's dinnertime: Findings and implications of national study of the cooking and eating habits of low-income American families. *J Acad Nutr Diet* 2012;112:A-85
- Seymour J, Yaroch AL, Serdula M, et al. Impact of nutrition environmental interventions on point-of-purchase behavior in adults: A review. *Prev Med* 2004;39:S108-S136
- Shaudies DA, Jones LB, Spear A, et al. The effect of socioeconomic status on nutrition and physical activity measures among school-aged children. *J Acad Nutr Diet* 2012;112:A-94
- Shin D, Hunt E, & Song W. Sociodemographic determinants of diet quality in U.S. pregnant women. *J Acad Nutr Diet* 2013;113:A-90
- Slining M, Mathias K, & Popkin B. Trends in food and beverage sources among U.S. children and adolescents: 1989-2010. *J Acad Nutr Diet* 2013;113:1683-1694
- Smith C, Butterfass J, & Richards R. Environment influences food access and resulting shopping and dietary behaviors among homeless Minnesotans living in food deserts. *Agric Hum Values* 2010;27:141-161
- Smith C, & Richards R. Dietary intake, overweight status, and perceptions of food insecurity among homeless Minnesotan youth. *Am J Hum Biol* 2008;20:550-563
- Song H, Gittelsohn J, Kim M, et al. A corner store intervention in a low-income urban community is associated with increased availability and sales of some healthy foods. *Pub Health Nutr* 2009;12:2060-2067
- Spalding B, Czarnecki N, Hallman W, et al. Can farmers markets improve access and consumption of fruits and vegetables in vulnerable populations? *J Acad Nutr Diet* 2012;112:A-72
- Stewart H & Blisard N. The Thrifty Food Plan and low-income households in the United States: What food groups are being neglected? *Food Policy* 2006;31:469-482
- Stewart H, Hyman J, Frazao, E, et al. Can low-income Americans afford to satisfy MyPyramid fruits and vegetable guidelines? *J Nutr Educ Behav* 2011;43:173-179
- Sund E. A tale of two food deserts: Mobile markets bring fresh foods to rural and urban communities. *Food & Nutrition Magazine* 2013;2(5):12-13

- Townsend M, Peerson J, Love B, et al. Food insecurity is positively related to overweight in women. *J of Nutr* 2001;131:1738-1745
- Townsend MS, Aaron GJ, Monsivais P, et al. Less-energy-dense diets of low-income women in California are associated with higher energy-adjusted diet costs. *Am J Clin Nutr* 2009;89:1220–1226
- U.S. Department of Agriculture & U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2010*. 7th Edition, Washington, DC: U.S. Government Printing Office, December 2010. Available at: <http://www.health.gov/dietaryguidelines/> Accessed January 22, 2014
- U.S. Department of Agriculture, Food and Nutrition Service. (2014) Supplemental Nutrition Assistance Program (SNAP): Eligibility. Available at: <http://www.fns.usda.gov/snap/eligibility> Accessed April 10, 2014
- U.S. Department of Agriculture. (2012 a.) Economic Research Service, *U.S. Household Food Security Survey Module: Six-Item Short Form*. Washington, DC: U.S. Government Printing Office, September 2012. Available at: http://www.ers.usda.gov/datafiles/Food_Security_in_the_United_States/Food_Security_Survey_Modules/short2012.pdf Accessed January 12, 2014
- U.S. Department of Agriculture. (2012 b.) Economic Research Service. *U.S. adult food security survey module: Three-stage design, with screeners: 10 items*. Washington, DC: U.S. Government Printing Office; 2013. Available at: http://www.ers.usda.gov/datafiles/Food_Security_in_the_United_States/Food_Security_Survey_Modules/ad2012.pdf Accessed January 12, 2014
- U.S. Department of Agriculture. (2012 c.) Economic Research Service, *U.S. adult food security survey module: Three-stage design, with screeners: 18 items*. Washington, DC: U.S. Government Printing Office, September 2012. U.S. Department of Agriculture. Available at: http://www.ers.usda.gov/datafiles/Food_Security_in_the_United_States/Food_Security_Survey_Modules/ad2012.pdf Accessed January 12, 2014
- U.S. Department of Agriculture. (2013 a.) Center for Nutrition Policy and Promotion, *Diet quality of Americans in 2001-02 and 2007-08 as measured by the Healthy Eating Index-2010*. Nutrition Insights 51. Washington, DC: U.S. Government Printing Office; 2013 Available at: <http://www.cnpp.usda.gov/Publications/NutritionInsights/Insight51.pdf> Accessed January 12, 2014
- U.S. Department of Agriculture. (2013 b.). Center for Nutrition Policy and Promotion. *Diet quality of children age 2-17 years as measured by the Healthy Eating Index-2010*. Nutrition Insights 52. Washington, DC: U.S. Government Printing Office; 2013. Available at: <http://www.cnpp.usda.gov/Publications/NutritionInsights/Insight52.pdf> Accessed January 12, 2014
- U.S. Department of Agriculture. (2013 c.) Center for Nutrition Policy and Promotion, *Official USDA food plans: Cost of food at home at four levels, U.S. average, June 2013*. Washington, DC: U.S. Government Printing Office; 2013 Available at: <http://www.cnpp.usda.gov/Publications/FoodPlans/2013/CostofFoodJun2013.pdf> Accessed January 12, 2014

- U.S. Department of Agriculture. (2014). SuperTracker. Available at: <https://www.supertracker.usda.gov/> Accessed April 1, 2014
- U.S. Department of Education. (2014). Federal TRIO programs: Current-year low-income levels. Available at: <http://www2.ed.gov/about/offices/list/ope/trio/incomelevels.html> Accessed April 20, 2014
- Wang Y, Jahns L, Tussing-Humphreys L, et al. Dietary intake patterns of low-income urban African-American adolescents. *J Acad Nutr Diet* 2010;110:1340-1345
- Waterlander WE, De Haas WE, Van Amstel I, et al. Energy density, energy costs and income—how are they related? *Pub Health Nutr* 2010;13:1599–1608
- Webber C, Sobal J, & Dollahite J. Shopping for fruits and vegetables. Food and retail qualities of importance to low-income households at the grocery store. *Appetite* 2010;54:297-303
- Whaley S, Koleilat M, Whaley M, et al. Impact of policy changes on infant feeding decisions among low-income women participating in the special Supplemental Nutrition Program for Women, Infants, and Children. *Am J Pub Health* 2012;102:2269-2273
- Wiig K & Smith C. The art of grocery shopping on a food stamp budget” factors influencing the food choices of low-income women as they try to make ends meet. *Pub Health Nutr* 2008;12:1726-1734
- Winkler E, Turrell G, & Patterson C. Does living in a disadvantaged area mean fewer opportunities to purchase fresh fruit and vegetables in the area? Findings from the Brisbane food study. *Health & Place* 2006;12:306-319
- Zenk S, Powell L, Odoms-Young A, et al. Impact of the revised Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) food package policy on fruit and vegetable prices. *J Acad Nutr Diet* 2014;114:288-296