

**EFFECT OF AN UNOBTRUSIVE AND LOW-COST NUDGE ON FOOD
CHOICE BEHAVIOR OF FOOD PANTRY CLIENTS**

by
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To my family

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ABSTRACT

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Title: Effect of an Unobtrusive and Low-Cost Nudge on Food Choice Behavior of Food Pantry Clients

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Understanding the effect of food insecurity of vulnerable individuals is necessary to develop strategies for improving lives of those individuals. In this study I explore the effect of a low-cost, unobtrusive intervention on food pantry clients' choice of healthier food items at a local food pantry. A cross-sectional study was conducted at a food pantry in the Midwest U.S. using the randomized controlled trial method. Participants in the intervention group received a nutrition ranking information about the food items in the pantry during their visit. Both the intervention and control groups reported their food selections. Additionally, client demographic information was collected in surveys. Data were collected from October 2018 to January 2019. A total of 615 adults were recruited and randomized for the nutrition ranking intervention (n=300) and control group (n=315). Multiple linear regression models were used to predict the outcomes of the intervention while controlling for demographic characteristics such as age, gender, household size, and education level. There was no significant response to the nutritional ranking intervention as it appears that the intervention was ineffective at changing behavior. Results suggest that future studies are needed to determine a low-cost intervention for food pantry clients during their short time at the food pantry.

CHAPTER 1. INTRODUCTION

1.1 Background

Eating balanced meals with the appropriate proportions of each food group is considered a healthy diet (Heath, 2011; Lim, 2018). However, according to the 2015-2020 Dietary Guidelines for Americans, 75 percent of the population have lower intake of vegetables, fruits, dairy, and healthy oils (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015). Poor dietary habits lead to health problems in the long-run. In fact, USDA's MyPlate and 2015-2020 Dietary Guidelines for Americans report half of all American adults having one or more chronic diseases that are caused by poor diets (2018). People's diets vary for many reasons. We consider a healthy diet to demonstrate food intake patterns that meet the particular nutritional needs that are necessary for one's health (De Ridder, Kroese, Adriaanse, Gillebaart, 2017). When individuals do not have adequate access to foods that contribute to a healthy diet, they may be considered food insecure (United States Department of Agriculture, 2017). This inadequate access to food may be caused by a number factors such as limited mobility, living in a food desert, and insufficient income (Nord, Andrews, & Carlson, 2009; Hilbert, Evans-Cowley, Reece, Rogers, Ake, & Hoy, 2016). The latest income and poverty statistics from the United States Census Bureau reported 39.7 million Americans are living in poverty (United States Census Bureau, 2018). Various studies indicate low-income individuals have limited ability to purchase food in sufficient quantities (Drewnowski & Darmon, 2005; Nackers and Appelhans, 2013).

The food pantry we collaborated with distributes over 7 million pounds of food per year in North Central Indiana. By weight, 40 percent of food comes from donations by manufacturers and retailers; 23 percent are purchased; 20 percent are U.S. Department of Agriculture (USDA) commodities; 12 percent are transfers from other food banks; 3 percent are donations from individual farmers; and 2 percent are donations from food drives. The food pantry is located along a bus route, which allows clients without personal automobiles to access the facility via public transportation. This particular food pantry is open to everyone, and there is no need for proof of low-income status to receive food items. The organization works with the clients to help them become more self-sufficient within their resource constraints. Each day, the food bank has a limited quantity and range of items available, usually including bread, milk, and eggs. The items

are sorted and verified to make sure they conform to USDA guidelines regarding the expiration and condition of items before they are made available to the public. There is no limit on the amount of food in pounds that clients can take home. Sometimes, however, items such as milk and meat have restricted quantities per household size to ensure the pantry resources can assist as many clients as possible.

1.1.1 Nutrition Quality for Food Banks

Food insecure families may turn to emergency food sources, often in the form of food pantries. Food banks are an essential part of the U.S. emergency food system and are often referred to as the “foundation” of that system (Handforth, Henninck, & Schwartz, 2013). With an increase in families relying on food banks for a part of their diet, it is potentially worthwhile to seek improvement of the nutritional choices on the food bank clients. According to the food pantry we partnered with, clients are using the food pantry as a regular supplement rather than an emergency food source. With the emergence of studies showing food insecurity being linked to obesity and other diet-related diseases, organizations such as food pantries are now promoting more nutritious food products such as fresh produce (Handforth et. al, 2013).

There is a need for more fresh fruits and vegetables in the food banks and pantries (Simmet et. al, 2016). However, previous studies found that energy dense foods high in carbohydrates and low in nutrients are more easily accessible and affordable to the food banks and food pantries than healthier items (Shanks, 2016). This can increase the likelihood of clients choosing unhealthy foods. A study by Handforth et. al. (2013) found that some food banks already use a nutritional profiling system to ensure that the total distribution of food targets the necessary nutrients required by the Reference Daily Intake index. Our concern here is with the selection of nutritious food items by food pantry clients.

1.2 Problem Statement

Food insecurity has been associated with nutrition-related chronic diseases, obesity, stress, and coping strategies (Morales & Berkowitz, 2016; Hoisington, Shultz, and Butkus, 2002). According to the most recent survey from the USDA, 40 million Americans lived in food-insecure households in 2017 (United States Department of Agriculture, 2017).

Food assistance programs and organizations such as food pantries strive to address food insecurity in local communities (Shanks, 2017). However, food pantries are often faced with the challenges of balancing nutritional needs of clients, client preferences, the pantry's budget, donated food products, and food availability for purchase (Companion, 2010; Rochester, Nanney, & Storey, 2011). It has been reported that while food pantries do have a strong influence on users' diets, the food pantries examined were largely unable to support healthy diets because fresh fruit and vegetables have a short shelf life (Hoisington et. al, 2011). With an increase in food pantry users over the past few years, it is important to explore how the food pantries and food banks can increase the nutritional quality of their food distributions.

Studies show that nutrient intake of food pantry clients may be inadequate (Duffy, Zizza, Jacoby, & Tayie, 2009; Mousa & Freeland-Graves, 2019). While food pantries influence the nutritional intake and health of food insecure individuals by providing access to food, pantry users do not consistently consume fresh fruits and vegetables (Mabli, Jones, & Kaufman, 2013; Edebohls, 2016). The problem this study seeks to address is whether an unobtrusive intervention at a food pantry will nudge clients to make healthier decisions. With the help of interventions that increase access and identification of healthy foods at food pantries, clients may be able to improve their diet quality.

1.3 Research Objectives and Hypothesis

This study is designed to explore whether a low-cost, unobtrusive intervention will nudge pantry clients to select healthier food items while visiting the pantry. The research objectives that guided this study are:

- 1) To identify clients' motivations and barriers affecting their decisions to visit the pantry. We hypothesize that the types of food available at the food pantry most influences the clients to visit. Because the collaborating food pantry utilizes the "client-choice" model, pantry users can select their own items in any combination given that they stay within the limits required by the food pantry.
- 2) To determine the frequency with which clients at client-choice food pantries select nutritious foods. We hypothesize that clients select a high proportion of foods that do not have high nutritional contents.

3) To determine the impacts of a nutritional education intervention on client food choices. We hypothesize that a brief, educational intervention in the form of a page illustrating the nutritional information of available food items with star ratings from zero to three stars will encourage clients to choose healthy food items due to the ease of identifying them at the pantry.

These objectives are addressed using a randomized controlled trial survey. In this study, survey participants were randomly assigned to either the control and intervention group. For both groups, we collected clients' demographic and pantry usage patterns information, recorded the food items the clients selected, and assigned a score to their food bundle based on the Healthy Eating Index (HEI) and Guiding Star Rating Nutrition system to support the three objectives mentioned above. Participants in the treatment group were provided with simple information regarding the "healthiness" of available food items in the pantry. These data were useful for measuring the extent to which the information provided to the treatment group influenced the food selection choices. Analysis of these data also allowed us to identify the demographic factors that may be associated with a greater response to the intervention that provides the nutrition information.

1.4 Study Rationale and Significance

This research contributes to the efforts to identify factors that influence pantry user decision making at local food pantries. At the theoretical level, this study is significant for two reasons: 1) it helps our understanding of the effectiveness of a brief educational intervention for improving diet choices in the short run, and 2) it helps us understand what factors impact client responsiveness to this type of intervention.

Understanding food insecurity and which individuals may benefit from a simple educational intervention may reveal strategic avenues for improving the lives of food insecure individuals. Examining how a food pantry can facilitate identification of healthy food items in food distribution is one step in the process of improving dietary choices for at-risk consumer populations.

CHAPTER 2. LITERATURE REVIEW

Several studies have focused on how to encourage people to choose healthy foods in the grocery stores and emergency food systems. In efforts to simplify the process of finding healthy food items in grocery stores, nutrition scoring and labeling systems have been created for consumers at the point of sale. Systems such as the Guiding Stars, Nuval, and Traffic Light Label have been introduced at retailers to promote healthy food choices (Nikolova and Inman, 2015). These systems allow consumers to quickly identify and compare foods that are nutritious during the shopping experience.

2.1 Access to Food Pantries and Healthy Food

In the context of emergency food systems, various researchers have examined different intervention methods to encourage healthier food selections for food pantry clients. Food pantry clients have been found to be generally supportive of healthy food options (Cooksey-Stowers et al. 2018). This however does not always translate to selections consisting of healthier foods. Food availability, food acceptability, and convenience also influence consumers' food choices (Dachner, Ricciuto, Kirkpatrick, and Tarasuk, 2010). These studies vary in the intrusiveness of the intervention program, experimental controls, as well as the quantity of the food items studies.

Martin et al. (2013) studied interventions for influencing client choice in the context of the Freshplace food pantry model. In this client choice pantry, clients had regular scheduled meeting with a project manager to work towards the goal of becoming food secure and self-sufficient. There also were referral services to connect clients to assistance in dealing with other challenges they are facing. Subjects were separated into treatment and control groups. The control group attended traditional pantries while the treatment group attended the client choice pantry. Using the Block Food Frequency Screener (Block et al. 2000) they assessed the fruit and vegetable intake of the treatment and control groups. Participation in the Freshplace pantry program lead to an increase of one additional fruit/vegetable serving per day. Though successful in improving eating habits, such a program may be too resource intensive to be practically implemented at many food pantries.

The use of “nudges” are a common way of influencing healthier food choices. These are minor changes to the choice environment that may alter an individual's behavior and/or decision

(Thaler and Sunstein, 2009). It is estimated that individuals make over 200 food-related decisions per day (Wansink et al. 2007). Research has found that nudges may be better at guiding healthier food choices than prohibitions and restrictions, and decisions made impulsively may not always lead to the most nutritious choices (Wilson, 2016).

Rivera et al. (2016) identified placement and presentation as a potential intervention for food pantries to improve client choice. These categories were useful for leveraging food information offered to clients such as signage and nutritional value assessment. Also reported by Rivera et al. (2016) were potential influential characteristics to client choice including the order in which food is presented, noticeability of an item, convenience of reaching the item, packaging attractiveness, and abundance of the item. Strategies that could influence the information offered to clients included: signage, nutrition labeling or value assessment, order forms to deter impulse selections, and increasing the frequency of exposures to desired items. Similarly, Wilson et al. (2017) also studied the relationship between packaging and placement on the frequency of client choices of healthier food items. They found that placing a healthier choice earlier in the client's view as well as leaving items in original packaging increased the client's probability of selecting the healthier choice. A noted limitation in the study suggested the healthier items became more prevalent later during the study intervals as less healthy choices were depleted.

Trends in food consumption indicate consumers are more aware of the ways in which foods effect their health (Chrysochou, 2010; Siro´ Ka´ polna, E., Ka´ polna, B., & Lugasi., 2008; Verbeke, 2005). Therefore, the ability to quickly compare food products may allow for ease in selecting healthy foods based on their attributes to health (Marchi, Caputo, Nayga., & Bantle, 2016). Recent studies at client choice food pantries explore and evaluate the effects of food scoring and labeling systems on client choices. Coombs (2018) evaluated the effectiveness of the Thumbs Up for Healthy Choices program using shelf labels to identify items that were low in sodium, added sugar and saturated and trans-fat. Results of the study indicated that the labeling initiative helped clients make healthier food choices.

2.2 Impacts of Nutrition & Education Interventions

A recent study examined the impact of the SuperShelf program on client healthy food choices (Capsi, Canterbury, Carlson, & Bain, 2019). The SuperShelf program contains six steps including stocking standards and aspects from behavioral economics. The steps consist of

increasing the quantity of more nutritious food, adding variety to the healthy food options, organizing the items by food groups to emphasize fruits, vegetables and less processed foods, improving signage to promote the healthy options, surveying to evaluate the client response to the program, and client's food sustainability efforts. They studied multiple client-choice food pantries and used client cart HEI scores to evaluate the nutritional values of the items selected. They found that increases in the nutritional content of the client choices were possible with the SuperShelf system.

Stein et al. (2019) performed a study that used ingredient bundling and recipe tastings to influence client choice. They found that ingredient bundling effective in encouraging the selection of healthier food items such as kale, brown rice and whole-wheat pasta in comparison to recipe tasting, which had minimal effect. Though there appears to be a strong desire among food pantry staff to guide clients to healthier choices (Cooksey-Stowers et al. 2018), no intervention method is universally effective. Variation in geographic location, donations, and access to food variety are among the many factors that influence what type of intervention makes sense for a particular pantry (Rivera et al. 2016).

Implementing intrusive intervention methods can be a challenge for many client choice food pantries. Firstly, the sense of free choice must be preserved as it is a key characteristic of the pantry. Secondly, limited budgets and personnel restrict how much effort can be dedicated to the nutritional ranking of food items. Should a pantry receive community donations the sheer variety of potential food choices available to clients can make continual categorization a daunting task. Ideally an intervention method would place minimal burdens on the pantry clients as well as staff and yet produce consistent, measurable benefits to the nutritional value of the client selections.

Our study observes the use of the Guiding Star Rating system to a randomly assigned intervention group at a food pantry to learn whether clients selected healthier foods compared to clients in the study that did not know about the Guiding Star Rating system upon selecting food items during their pantry visit.

CHAPTER 3. MATERIALS AND METHODS

3.1 Study Sample and Recruitment

In the Fall 2018, a randomized controlled study was conducted at a Midwest Food Pantry. We surveyed 652 food pantry clients who were at least 18 years of age. A total of 37 surveys were dropped due to incomplete questionnaires, resulting in a sample of 615 food pantry clients. Data collection spanned a 21-day period between October and January.

The specific procedures for the survey participants began with the recruitment of clients in the food pantry's waiting room. Food pantry clients were asked to voluntarily participate in the study. If willing to participate, clients were asked to sign a face-to-face consent form. Additionally, clients were asked to grant permission for us to record their food pantry item selections upon checkout. After consenting to these steps, clients completed a 7-10 minute survey about their food pantry experience, needs, and demographic information. Once the survey was completed, clients selected their food items and returned the survey to us. We then recorded the type and quantity of the food items selected.

3.2 Survey Data Collection:

We collected the following information from the pre-shopping survey: 1) client demographic information (age, gender, race, income, marital status, etc.); 2) client extrinsic motivation for visiting the food pantry; 3) client perception of barriers that might prevent them from making a healthy decision while at the pantry; 4) food items and products most desired from the food pantry; 5) client knowledge pertaining to nutrition label and diets. Both the control and intervention groups' surveys included these questions. The last step of the survey was to record the number and type of items chosen by the clients from the food pantry at checkout.

Only the intervention group received nutritional information. The intervention was in the form of a page at the end of the survey that was administered prior to the client's food item selections that included pictures of the non-perishable food items available for the day with Guiding Star Rating next to each item. The Guiding Star Ratings provide consumers with an easy way to assess the nutritional value of the food items. These ratings use only stars and range from zero stars to three stars (Fischer, Kaley, Fox, Hasler, Nobel, Blumberg, 2011). This system was

created in the 1990's for use as a scoring method to measure dietary quality (Kennedy, 2008). For this study, 157 items were rated using the Guiding Star Rating System. The specific food items and their Guiding Star Rating can be found in Appendix A.

3.3 Intervention

The intervention group received a nutritional ranking information on the end of their survey, which included Guiding Star Ratings for non-perishable food items, such as that in Appendix D. For instance, if peanut butter was available for distribution at the food pantry that day, a picture of the jar of peanut butter, its name, and a guiding star rating of 2 was listed for the item. Clients were informed at the beginning of the intervention that the ratings were defined as : 0 stars means “no guiding star rating due to the item not meeting minimum nutritional criteria to earn a star”, 1 star means “good”, 2 stars means “better”, and 3 stars means “best” nutritional value (Guiding Stars, 2019). The objective of the intervention was to make clients aware of the nutritional value of items.

3.4 Descriptive Analysis

We focus on differences between the intervention and control group. We begin by generating summary statistics of the mean and standard deviation for the demographic variables with respect to the intervention or control group. The demographic variables include gender, age, marital status, education level, household size, number of adults, and employment. We test the statistical significance of differences between the intervention and control group at the 5% level using the test statistic. Ideally, no statistically significant differences will be found between the control and treatment group – this indicates that the randomization scheme was effective.

Within our sample, we examine the frequencies of responses generated for questions regarding client extrinsic motivation for visiting the food pantry, client perception of barriers that might prevent them from making a healthy decision while at the pantry; food items and products most desired from the food pantry, and client knowledge pertaining to nutrition label and diets.

3.5 Summary of Outcome Variable Construction

In addition to using the Guiding Stars to evaluate the quality of the food choices, we calculated a nutrition index for the client's total food bundle using the recorded food items. This

index is based on the USDA Center for Nutrition Policy and Promotion's Healthy Eating Index (HEI), which measures diet quality. The HEI also measures how well the set of foods aligns with key recommendations set by the Dietary Guidelines for Americans. The HEI procedure, originally developed in 1995, has evolved over the years as dietary recommendations changed (Kennedy, Ohls, Carson, Flemming, 1995). The most recent index was developed in 2015 based on the 2015-2020 Dietary Guidelines for Americans (Kerbs-Smith et al., 2018). This index is referred to here as HEI-2015.

There are 13 nutritional categories evaluated in HEI-2015. Depending on how dietary choices align with each category, a certain number of points is awarded. Traditional methods of nutritional monitoring, such as food diaries and food frequency questionnaires, can be time consuming and prone to error (Tran et al. 2015). Studies have proposed using food selections during grocery purchasing as the basis of calculating an HEI score (Tran et al. 2015 and Tran et al. 2017). Such a method seemed highly appropriate for assessing the individuals in the client-choice food pantry.

Using the recorded food items, we calculated a nutrition index for the client's total food bundle. In this system, we record the following components: total fruits, whole fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, fatty acids, refined grains, sodium, added sugars, and saturated fats.

To perform the calculations, detailed nutritional information on each of the food items needed to be sourced. Using information from USDA Food Composition Databases and package nutrition labels, quantifying metrics for 12 of the nutritional categories used in the HEI calculation were estimated. Accurate values could not be uniformly determined for the added sugars since many labels did not differentiate between inherent vs. added sugar content. As such we substituted total sugar content for added sugars throughout this analysis.

To facilitate the HEI calculation, a Python script was developed. After reading data files on the client food choices and nutritional data on the individual food items the program then executed the following procedure for each client:

1. The total caloric content of the items selected was determined by summing over each item (i)

$$TotalCalories = \sum_i^n CaloriesPerServing_i * NumberOfServings_i$$

2. A density contribution factor was used to determine how much a food item attributed to each HEI category. The density contribution metric for each of the 12 HEI categories as well as the criteria for the minimum and maximum score in each category are shown in Table 3.1. If a calculated value for $HEI_{metric,j,i}$ was smaller than the Minimum Score Criteria, it was replaced by the Minimum Score. Likewise, if a calculated value for $HEI_{metric,j,i}$ was greater than the Maximum Score Criteria, it was replaced by the Maximum Score.

Table 3.1 HEI density definitions and scoring criteria

HEI Category (j)	Density Metric ($HEI_{metric,j,i}$)	Minimum Score Criteria	Maximum Score Criteria
Adequacy Categories			
Total Fruits	$\frac{\text{Cups Total Fruit}}{\text{TotalCalories}} \cdot 1000$	0 cup equiv. per 1,000 kcal	≥ 0.8 cup equiv. per 1,000 kcal
Whole Fruits	$\frac{\text{Cups Whole Fruit}}{\text{TotalCalories}} \cdot 1000$	0 cup equiv. per 1,000 kcal	≥ 0.4 cup equiv. per 1,000 kcal
Total Vegetables	$\frac{\text{Cups Vegetables}}{\text{TotalCalories}} \cdot 1000$	0 cup equiv. per 1,000 kcal	≥ 1.1 cup equiv. per 1,000 kcal
Greens and Beans	$\frac{\text{Cups Greens and Beans}}{\text{TotalCalories}} \cdot 1000$	0 cup equiv. per 1,000 kcal	≥ 0.2 cup equiv. per 1,000 kcal
Whole Grains	$\frac{\text{oz. Whole Grains}}{\text{TotalCalories}} \cdot 1000$	0 oz equiv. per 1,000 kcal	≥ 1.5 oz equiv. per 1,000 kcal
Dairy	$\frac{\text{Cups Dairy}}{\text{TotalCalories}} \cdot 1000$	0 cup equiv. per 1,000 kcal	≥ 1.3 cup equiv. per 1,000 kcal
Total Protein Foods	$\frac{\text{oz. Total Protein}}{\text{TotalCalories}} \cdot 1000$	0 oz equiv. per 1,000 kcal	≥ 2.5 oz equiv. per 1,000 kcal
Seafood and Plant Proteins	$\frac{\text{oz. Seafood – Plant Protein}}{\text{TotalCalories}} \cdot 1000$	0 oz equiv. per 1,000 kcal	≥ 0.8 oz equiv. per 1,000 kcal

Table 3.1 continued

Fatty Acids	$\frac{\text{grams PUFAs} + \text{grams MUFAs}}{\text{grams SFAs}}$	(PUFAs + MUFAs)/SFAs ≤ 1.2	(PUFAs + MUFAs)/SFAs ≥ 2.5
Moderation Categories			
Refined Grains	$\frac{\text{oz. refined grams}}{\text{TotalCalories}} \cdot 1000$	≥ 4.3 oz equiv. per 1,000 kcal	≤ 1.8 oz equiv. per 1,000 kcal
Sodium	$\frac{\text{grams sodium}}{\text{TotalCalories}} \cdot 1000$	≥ 2.0 gram per 1,000 kcal	≤ 1.1 gram per 1,000 kcal
Added Sugars	$\frac{\text{calories from Sugar}}{\text{TotalCalories}}$	$\geq 26\%$ of energy	$\leq 6.5\%$ of energy
Saturated Fats	$\frac{\text{calories from Fat}}{\text{TotalCalories}}$	$\geq 16\%$ of energy	$\leq 8\%$ of energy

*PUFAs: polysaturated fatty acids

*MUFAs: monounsaturated fatty acids

*SFAs: saturated fatty acids

- For each food item that a client selected, its density contribution to an HEI category (j) was determined using the density definition metric for that category. The total density value for a category was determined from the sum of contribution from each food item selected in the client bundle.

$$HEI_{density,j} = \sum_i^n HEI_{metric,j,i}$$

- The calculated density values were then used in conjunction with the scoring criteria outlined by Kerbs-Smith et al. (2018). A linear scaling was used to assign points depending on how the calculated density value compared to the standard for the minimum and maximum score. The calculation procedure for the score in each HEI category as well as the maximum amount of points attributed to that category are shown in Table 3.2.

Table 3.2 Calculations for scaling score for each HEI category

HEI Component (j)	Max Points	Scaling Relationship ($HEI_{score,j}$)
Adequacy Components:		
Total Fruits	5	$\min\left(5, \frac{5}{0.8} \cdot HEI_{density, TotalFruits}\right)$
Whole Fruits	5	$\min\left(5, \frac{5}{0.4} \cdot HEI_{density, WholeFruits}\right)$
Total Vegetables	5	$\min\left(5, \frac{5}{1.1} \cdot HEI_{density, TotalVeg}\right)$
Green Beans	5	$\min\left(5, \frac{5}{0.2} \cdot HEI_{density, Green\&Beans}\right)$
Whole Grains	10	$\min\left(10, \frac{10}{1.5} \cdot HEI_{density, WholeGrains}\right)$
Dairy	10	$\min\left(10, \frac{10}{1.3} \cdot HEI_{density, Dairy}\right)$
Total Protein Foods	5	$\min\left(5, \frac{5}{2.5} \cdot HEI_{density, TotalProtein}\right)$
Seafood and Plant Protein	5	$\min\left(5, \frac{5}{0.8} \cdot HEI_{density, Seafood\&Plant}\right)$
Fatty Acids	10	$\min\left(10, \frac{10}{2.5 - 1.2} \cdot \max(HEI_{density, FattyAcids} - 1.2, 0)\right)$
Moderation Components:		
Refined Grains	10	$\min\left(10, 10 - \frac{10}{4.3 - 1.8} \cdot \max(HEI_{density, RefinedGrains} - 1.8, 0)\right)$
Sodium	10	$\min\left(10, 10 - \frac{10}{2.0 - 1.1} \cdot \max(HEI_{density, RefinedGrains} - 1.1, 0)\right)$
Added Sugars	10	$\min\left(10, 10 - \frac{10}{0.26 - 0.065} \cdot \max(HEI_{density, Sugar} - 0.065, 0)\right)$
Saturated Fats	10	$\min\left(10, 10 - \frac{10}{0.16 - 0.08} \cdot \max(HEI_{density, SatFats} - 0.08, 0)\right)$

Once HEI scores for each category were determined based on a client's food bundle, a Nutrition Index was calculated as the sum of the HEI score contributions from each of the HEI categories.

$$\text{Nutrition Index} = \sum_j^n \text{HEI}_{\text{score},j}$$

3.6 Outcome Variables

The overarching objective was to determine whether our educational intervention had a statistically significant effect on our intervention group. Therefore, we constructed three variables as our outcome variables: *proportion n star*, *total star*, and *nutrition index*. We determined that such calculations could identify the frequency with which clients select each category of ratings. Based on the client's bundle of food items, and the respective Guiding Star rating for each item, we generated two variables to quantify the nutritious quality of the bundle:

1. For each client, we wanted to find the fraction of items selected in each rating category. In the first method, we compared the quantity of each Guiding star category with the total quantity of the respective guiding star rating available.

$$\text{Proportion 'n'-star Available} = \frac{\text{Number of unique } n'\text{-star food items selected}}{\text{Number of unique } n'\text{-star items available}}$$

Where 'n' = 0,1,2,3

2. For each client, we also wanted to compare the fraction of items selected in each rating with the total number of items in the bundle.

$$\text{Total 'n'-star} = \frac{\text{Number of } n'\text{-star food items selected}}{\text{Number of all items selected}}$$

Where 'n' = 0,1,2,3

Table 3.3 describes the models used in this study to determine the effects of the intervention where β represents the coefficients for each variable and X_i represents each demographic variable per client. The demographic variables in these models included gender, age of client, marital status, education level, number of household adults, number of household children, household size, and ethnicity.

Table 3.3 Model Descriptions

Model 1	$(Nutrition\ Index)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon_i$
$Proportion\ 'n'\text{-star}\ Available = \frac{Number\ of\ unique\ 'n'\text{-star}\ food\ items\ selected}{Number\ of\ unique\ 'n'\text{-star}\ items\ available}$	
Model 2	$(Proportion\ 0\text{-star})_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 3	$(Proportion\ 1\text{-star})_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 4	$(Proportion\ 2\text{-star})_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 5	$(Proportion\ 3\text{-star})_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
$Total\ 'n'\ Star = \frac{Number\ of\ 'n'\text{-star}\ food\ items\ selected}{Number\ of\ all\ items\ selected}$	
Model 6	$(Total\ 0\text{-star})_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 7	$(Total\ 1\text{-star})_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 8	$(Total\ 2\text{-star})_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
HEI Components	
Model 9	$(Total\ 3\text{-star})_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 10	$(Total\ Fruits)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 11	$(Whole\ Fruits)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 12	$(Total\ Vegetables)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 13	$(Greens\ and\ Beans)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 14	$(Whole\ Grains)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 15	$(Dairy)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 16	$(Total\ Proteins)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 17	$(Seafood\ and\ Plant\ Proteins)_i$ $= \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 18	$(Fatty\ Acids)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 19	$(Refined\ Grains)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 20	$(Sodium)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 21	$(Added\ Sugars)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$
Model 22	$(Saturated\ Fats)_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_{2,i} + \dots \beta_{11} X_{11,i} + \varepsilon$

CHAPTER 4. DATA AND RESULTS

4.1 Summary of Demographic Characteristics

Our purpose was to investigate whether a brief, one-time educational intervention has effects on food pantry clients' food bundle selection. The clients' baseline characteristics and summary statistics for both groups are displayed in Table 4.1, where we find that the sample is balanced, and findings from t-tests indicate there were no statistical differences between the intervention and control group, as is consistent with expectations from random sampling.

Table 4.1 Averages of Food Pantry Client Demographics

Variable	Intervention Group Average	Control Group Average	All Average
Female	0.63 (0.48)	0.58 (0.49)	0.60 (0.49)
Age (years)	42.41 (15.38)	41.70 (13.49)	42.05 (14.44)
Married/ In a Relationship	0.26 (0.44)	0.27 (0.44)	0.26 (0.44)
Education <= High School	0.56 (0.50)	0.55 (0.50)	0.55 (0.50)
Household Number of Adults	2.35 (1.23)	2.18 (1.25)	2.27 (1.24)
Household Number of Children	1.32 (1.65)	1.16 (1.32)	1.24 (1.49)
Race = Non-Hispanic White	0.61 (0.49)	0.62 (0.49)	0.61 (0.49)
Race = Non-Hispanic Black	0.19 (0.40)	0.16 (0.37)	0.18 (0.38)
Race = Other	0.20 (0.40)	0.22 (0.42)	0.21 (0.41)
Household Size	3.77 (2.31)	3.38 (1.99)	3.57 (2.16)
Observations	300	315	615

Standard deviations are in parentheses.

4.2 Summary of Food Quality in the Food Pantry

Food items recorded from the study were assigned a Guiding Star Rating using the Guiding Star Rating database. In total, 157 items were rated for the study and are included in Appendix A. On average, clients surveyed selected 12 items per visit. Table 4.2 reports the average number of items selected by clients with respect to the ratings and intervention/control group. As described in table 4.2, roughly three Two Star items were recorded in client food bundles on average. On average, about one One Star item was in a client's food bundle.

Table 4.2 Average Number of Items Selected by Guiding Star Rating

	Treatment	Control	All
Variable	Mean	Mean	Mean
Zero Star	2.31 (1.69)	2.37 (1.71)	2.34 (1.70)
One Star	0.99 (0.71)	0.99 (0.69)	0.99 (0.70)
Two Star	3.01 (1.48)	2.98 (1.52)	3.00 (1.50)
Three Star	1.92 (1.32)	1.81 (1.17)	1.87 (1.24)
Observations	300	315	615

Standard deviations in parentheses.

4.3 Summary of Motivations and Perceived Barriers

Outcomes of interest were to identify food pantry clients' motivations and barriers of eating healthy using descriptive statistics. We asked clients what items they most desired from the food pantry. About 79% of clients surveyed reported they desired protein food items like meats when they visit the food pantry. Fresh fruit and vegetables were another category that 71% of clients indicated they desired from the food pantry during their visit. About 66% of clients desired dairy items from their pantry visit.

To characterize some of the barriers, we also asked clients what were some barriers that prevented them from making healthy choices while at the food pantry. About 45% of clients surveyed reported that produce not available was a barrier to their selection of healthy food items.

“No time to prepare healthy foods” was another response that about 19% of clients selected. See Appendix C for full table of statements for desired items and barriers.

4.4 Summary Statistics of Outcome Variables

The averages for the continuous outcome variables- *nutrition index*, *proportion ‘n’-star*, and *total ‘n’-star*, are displayed in **table 4.3**. For each of the 9 variables, student’s t-tests were performed to detect any statistically significant differences between the means of these variables for the treatment and control groups. Results from the t-tests indicated that there were no significant differences between the intervention and control groups for any of the outcome variables. To further test for statistically significant differences between the intervention and control groups, regressions for each of the 9 outcome variables also performed and reported in the next section.

Table 4.3 Averages of Outcome Variables by Group

Variable	Intervention Group Average	Control Group Average	All Average
Nutrition Index	54.60 (10.91)	55.26 (11.60)	54.94 (11.26)
Proportion Zero	0.47 (0.70)	0.50 (0.73)	0.49 (0.72)
Proportion One	0.55 (0.41)	0.57 (0.40)	0.56 (0.41)
Proportion Two	0.37 (0.18)	0.36 (0.20)	0.36 (0.19)
Proportion Three	0.15 (0.11)	0.14 (0.10)	0.15 (0.11)
Total Zero	0.28 (0.17)	0.30 (0.17)	0.29 (0.17)
Total One	0.16 (0.15)	0.16 (0.14)	0.16 (0.14)
Total Two	0.35 (0.15)	0.35 (0.15)	0.35 (0.15)
Total Three	0.22 (0.14)	0.21 (0.14)	0.22 (0.14)

Standard deviations in parentheses.

4.4.1 Nutrition Index as Outcome Variable

The regression results for the educational intervention and the *Nutrition Index* outcome variables are reported in **Table 4.4**. The *Nutrition Index* variable consisted of combined scores of nutritional categories as defined by HEI with respect to all items in the client's entire bundle. Based on our results, we do not reject our hypothesis, and conclude the educational intervention, which is represented by the Treatment variable, did not have a significant effect on the clients' bundle selection ($p>0.1$). Findings from **Model 1** indicate that having at least a high school diploma resulted in a lower *Nutritional Index* score. ($p>0.1$). The average HEI score calculated for the food bundles for clients surveyed in this study is 54.8 points. While the ideal score for overall HEI is 100, the average American only scores 59 out of 100. The R-squared value for the Nutrition index is 0.013 and the F-statistic is 0.84.

Table 4.4 Regression model with Nutrition Index as Outcome Variable; Controlling for Demographics Effect on Intervention

Variables	Model 1: Nutrition Index
Treatment	-0.751 (0.930)
Married/ In a Relationship	-0.776 (1.094)
Education <= High School	-2.311** (0.949)
Race = Non-Hispanic White	0.227 (1.197)
Race = Non-Hispanic Black	-0.954 (1.511)
Employed	-0.867 (0.958)
Female	1.478 (0.967)
Household Size	0.321 (0.401)
Age (years)	-0.479 (0.565)
Number of Children	-0.004 (0.034)
_cons	55.976 (2.103)

Standard deviations in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$

4.4.2 *Proportion n* as Outcome Variable

The *proportion 'n'* outcome variable is calculated for each Guiding Star Rating as the number of unique items selected in that Guiding Star Rating category divided by the total number of unique items in that Guiding Star Rating category. This calculation allows us to learn about the variety of unique items available to the client, one rating at a time. The regression results for the educational intervention and the *proportion 'n'* outcome variables are reported in **Table 4.5**. The *proportion 'n'* variable is representative of the fraction of the items in a Guiding Star Rating category that are selected relative to what was available. We hypothesized that the educational intervention would encourage clients to select greater fractions of the higher Guiding Star Rating categories compared to the control group. Results from all four *proportion* models indicate that clients did not significantly respond to the educational intervention ($p > 0.1$), which is represented by the Treatment variable. We did not reject our null hypothesis. Among the demographic variables, *employed*, was significant in the *proportion 'n' model* in which $n=3$ ($p < 0.1$). Clients indicating 'yes' to employed selected less of the one-star rated food items during their pantry visit, as seen in **Model 3**. Results for the Proportion 'Zero' model 2 reflect an R-squared value of 0.033 and F-statistic of 2.23. The Proportion 'One' model 3 has an R-squared value of 0.020 and F-statistic of 0.253. Results for the Proportion 'Two' model 4 reflect an R-squared value of 0.012 and F-statistic of 0.77. Results for the Proportion 'Three' model 5 reflect an R-squared value of 0.013 and F-statistic of 0.83.

Table 4.5 Impact of variety of unique items available to the client by one rating at a time

Variables	Model 2:	Model 3:	Model 4:	Model 5:
	Proportion 'Zero'	Proportion 'One'	Proportion 'Two'	Proportion 'Three'
	0 Star Item Types Selected	1 Star Item Types Selected	2 Star Item Types Selected	3 Star Item Types Selected
	0 Item Types Available	1 Item Types Available	2 Item Types Available	3 Item Types Available
Treatment	-0.045 (0.060)	-0.006 (0.035)	0.010 (0.015)	0.011 (0.009)
Married/ In a Relationship	-0.047 (0.071)	-0.012 (0.041)	0.006 (0.018)	-0.002 (0.011)
Education <= High School	-0.017 (0.061)	-0.029 (0.035)	0.018 (0.016)	0.001 (0.009)
Race = Non-Hispanic White	-0.046 (0.077)	-0.034 (0.045)	-0.026 (0.020)	0.000 (0.011)
Race = Non-Hispanic Black	-0.026 (0.097)	-0.082 (0.056)	-0.005 (0.025)	-0.006 (0.014)
Employed	-0.004 (0.062)	-0.069* (0.036)	0.020 (0.016)	-0.013 (0.009)
Female	-0.067 (0.062)	0.028 (0.036)	0.020 (0.016)	0.011 (0.009)
Household Size	0.036 (0.026)	-0.014 (0.015)	-0.003 (0.007)	-0.004 (0.004)
Age (years)	0.009 (0.002)	0.001 (0.001)	0.000 (0.001)	0.000 (0.000)
Number of Children	0.000 (0.036)	0.010 (0.022)	-0.002 (0.009)	0.004 (0.005)
_cons	0.113 (0.136)	0.650 (0.078)	0.345 (0.035)	0.174 (0.020)

Standard deviations are in parentheses. *p<0.1, **p<0.05, ***p<0.01

4.4.3 *Total n* as Outcome Variable

The regression results for the educational intervention and the *total n* outcome variables are reported in **Table 4.6**. The *total n* outcome variables are calculated as the fraction of selected items in Guiding Star Rating category divided by the total number of items selected by the client. This outcome variable indicates the frequency of selection of items by Guiding Star Rating as a fraction of their total selections. The hypotheses are that, for lower Guiding Star Ratings, the fraction of the bundle may be lower for the treatment group than for the control group, and for higher Guiding Star Ratings, the fraction of the bundle may be higher for the treatment group than for the control group. Based on our results, we do not reject our hypothesis, and conclude the educational intervention, which is represented by the Treatment variable, did not have a significant effect on the clients' bundle selection ($p > 0.1$). Findings from **Model 6** Total 'Zero' show children in the household as a significant predictor of whether zero-star rated items are selected ($p < 0.1$). Specifically, a one-unit decrease in the number of children in the household resulted in an increase in the fraction of the total number of items that rated zero stars. **Model 7** reflected a similar trend as **Model 6** with children being a significant predictor of selecting one-star rated items ($p < 0.5$). A one-unit decrease in the number of children in the household resulted in more one-star items being selected. As age increased, **Model 8** indicates that more two-star rated items are selected with 0.001 additional items selected per year of age ($p < 0.05$, $p < 0.1$). While this difference is statistically significant, it is not economically significant due to the small magnitude of the coefficient.

Table 4.6 Impact of Intervention and Demographic Variables on Overall Variety within Food Bundles (N=615)

Variables	Model 6:	Model 7:	Model 8:	Model 9:
	Total 'Zero'	Total 'One'	Total 'Two'	Total 'Three'
	0 Star Item Types Selected	1 Star Item Types Selected	2 Star Item Types Selected	3 Star Item Types Selected
	<i>Total Items Selected</i>	<i>Total Items Selected</i>	<i>Total Items Selected</i>	<i>Total Items Selected</i>
Treatment	-0.011 (0.014)	0.002 (0.011)	0.005 (0.012)	0.002 (0.011)
Married/ In a Relationship	-0.021 (0.017)	-0.001 (0.013)	0.011 (0.015)	0.013 (0.014)
Education <= High School	0.015 (0.015)	-0.019 (0.011)	0.011 (0.013)	-0.014 (0.012)
Race = Non-Hispanic White	0.009 (0.018)	-0.001 (0.014)	-0.022 (0.016)	0.018 (0.015)
Race = Non-Hispanic Black	-0.015 (0.023)	-0.015 (0.018)	0.017 (0.020)	0.008 (0.018)
Employed	0.006 (0.015)	-0.016 (0.011)	0.013 (0.013)	-0.006 (0.012)
Female	-0.019 (0.015)	-0.002 (0.012)	0.009 (0.013)	0.006 (0.012)
Household Size	0.009 (0.006)	-0.007 (0.005)	0.002 (0.005)	-0.003 (0.005)
Age (years)	0.000 (0.001)	-0.001 (0.000)	0.001** (0.000)	-0.001* (0.000)
Number of Children	-0.016* (0.009)	0.016** (0.007)	-0.002 (0.008)	0.004 (0.007)
_cons	0.279 (0.032)	0.201 (0.025)	0.289 (0.028)	0.241 (0.026)

Standard errors are in parentheses. *p<0.1, **p<0.05, ***p<0.01

4.4.4 HEI Components as Outcome Variable

In this study, HEI components were tested as the outcome variable to determine if there were statistically significant differences between the component values for the control and intervention groups. The average scores for the intervention and control group are noted in **table 4.7** with respect to the thirteen HEI components.

Table 4.7 Summary Statistics of HEI Components

Variable	Treatment Average	Control Average	All Average
total fruits	1.929 (2.001)	2.062 (2.092)	1.997 (2.048)
whole fruits	2.020 (2.215)	2.118 (2.266558)	2.070 (2.240371)
total vegetables	1.942 (1.898)	1.916 (1.920)	1.928 (1.907)
greens and beans	1.688 (2.310)	1.656 (2.288)	1.672 (2.297)
whole grains	1.678 (3.566)	1.919 (3.792)	1.801 (3.682)
dairy	4.548 (4.221)	4.599 (4.171)	4.574 (4.192)
total proteins	3.454 (0.854)	3.458 (0.894)	3.456 (0.874)
seafood and plant proteins	3.825 (1.186)	3.733 (1.289)	3.778 (1.240)
fatty acids	9.591 (1.399)	9.580 (1.322)	9.586 (1.359)
refined grains	2.917 (3.663)	2.676 (3.640)	2.794 (3.650)
sodium	7.068 (2.905)	7.377 (2.945)	7.226162 (2.927)
added sugars	4.928 (3.152)	5.209 (3.033)	5.0720 (3.092)
saturated fats	9.014 (1.980)	8.953 (1.963)	8.983 (1.970)
Observations	300	315	615

Standard deviations are in parentheses.

Note: See **table 3.1** for Weighted Scores used in Calculating HEI Components

The regression results for **Models 10-13** are shown in **table 4.8**. In these models, the educational intervention (the Treatment variable in Table 4.8) did not have a significant effect on the total fruits, whole fruits, total vegetables, or greens & beans variables. However, having at least a high school education resulted in a decrease in the scores associated with total fruits ($p<0.1$), total vegetables ($p<0.1$), and greens & beans ($p<0.1$). Results show that clients who identified as Non-Hispanic White selected less greens & beans ($p<0.05$). Clients who self-identified as Non-Hispanic Black selected less items containing whole fruits and total vegetables ($p<0.1$). In this study, female clients selected more items containing whole fruits ($p<0.1$), total vegetables ($p<0.1$), and greens and beans ($p<0.05$). A one unit increase in household size was also associated with a higher HEI component score in greens & beans. Increasing age was associated with a higher score of total vegetables.

Table 4.8 Regression Model with HEI Components (fruits and vegetables) as Outcome Variable

Variables	Model 10:	Model 11:	Model 12:	Model 13:
	Total Fruits	Whole Fruits	Total Vegetables	Greens & Beans
Treatment	-0.110 (0.171)	-0.095 (0.186)	0.012 (0.157)	-0.033 (0.189)
Married/ In a Relationship	-0.029 (0.201)	0.077 (0.219)	0.096 (0.185)	-0.069 (0.222)
Education <= High School	-0.293* (0.174)	-0.305 (0.190)	-0.286* (0.161)	-0.484* (0.193)
Race = Non-Hispanic White	-0.118 (0.220)	-0.164 (0.240)	-0.101 (0.203)	-0.162** (0.243)
Race = Non-Hispanic Black	-0.369 (0.277)	-0.500* (0.302)	-0.418* (0.256)	-0.449 (0.307)
Employed	0.079 (0.176)	0.030 (0.192)	-0.098 (0.162)	0.016 (0.195)
Female	0.099 (0.177)	0.368* (0.193)	0.410* (0.164)	0.566** (0.197)

Table 4.8 continued

Household Size	0.042 (0.074)	0.057 (0.080)	0.026 (0.068)	0.159* (0.082)
Age (years)	0.007 (0.006)	0.011 (0.007)	0.010* (0.006)	0.010 (0.007)
Number of Children	-0.074 (0.104)	-0.043 (0.113)	-0.013 (0.096)	-0.170 (0.115)
_cons	1.932 (0.386)	1.623 (0.421)	1.522 (0.356)	1.068 (0.428)

Standard deviations are in parentheses. *p<0.1, **p<0.05, ***p<0.01

The regression results for **Models 14-17** are shown in **table 4.9**. In these models, the educational intervention (represented by the Treatment variable) did not have a significant effect on the whole grains, total proteins, seafood and plant proteins, and fatty acids. In **Model 14**, in which whole grains was the outcome variable, we find that those having at least a high school diploma selected less whole grain items ($p<0.01$). In **Model 15**, increasing age was associated with higher total proteins score ($p<0.1$). Similar to **Model 14**, we find in **Model 16**, there is a negative relationship between increasing education level and the Seafood & Plant Proteins variable. In **Model 17**, we find that an increase in age results in a decrease in fatty acids score.

Table 4.9 Regression Model with HEI Components (Whole Grains, Proteins, Fatty Acids) as Outcome Variable

Variables	Model 14: Whole Grains	Model 15: Total Proteins	Model 16: Seafood & Plant Proteins	Model 17: Fatty Acids
Treatment	-0.303 0.303	-0.011 0.072	0.086 0.102	0.062 0.108
Married/ In a Relationship	-0.049 0.356	-0.086 0.084	0.068 0.119	0.026 0.127
Education <= High School	-0.803*** 0.309	0.030 0.073	-0.312** 0.104	-0.035 0.110
Race = Non-Hispanic White	0.208 0.390	0.003 0.092	0.176 0.131	0.205 0.139

Table 4.9 continued

Race = Non-Hispanic				
Black	0.226	0.086	-0.067	0.075
	0.492	0.116	0.165	0.175
Employed	-0.246	0.076	0.094	0.009
	0.312	0.074	0.105	0.111
Female	0.155	-0.118	0.109	0.143
	0.315	0.075	0.106	0.112
Household Size	0.008	-0.047	0.055	0.020
	0.131	0.031	0.044	0.047
Age (years)	-0.016	0.005*	-0.001	-0.008**
	0.011	0.003	0.004	0.004
Number of Children	-0.005	0.017	-0.009	0.032
	0.184	0.044	0.062	0.066
_cons	2.862	3.432	3.519	9.586
	0.685	0.162	0.230	0.244

Standard deviations are in parentheses. *p<0.1, **p<0.05, ***p<0.01

Models 18-21 contain the HEI components that are listed as “moderation items”. High scores in these components reflect lower intakes of the dietary elements. Lower intakes are most ideal. None of the variables in **Models 18** and **19** were significant. However, in **Model 20**, results show that increases in education level resulted in higher scores in added sugars (p<0.5). Additionally, the variable Non-Hispanic Black (p<0.1) was significant indicating that less of added sugars were consumed as shown in **Model 20**. Results show that female clients surveyed consumed less saturated fats than their male counterpart (p<0.05) in **Model 21**. Dually noted, an increase in household size is associated with lower intakes of saturated fats.

Table 4.10 Regression Model with HEI Components (Refined Grains, Sodium, Added Sugars, Saturated Fats) as Outcome Variable

Variables	Model 18: Refined Grains	Model 19: Sodium	Model 20: Added Sugars	Model 21: Saturated Fats
Treatment	0.198 (0.301)	-0.274 (0.244)	-0.391 (0.256)	0.069 (0.159)
Married/ In a Relationship	-0.070 (0.354)	-0.045 (0.288)	-0.012 (0.301)	0.120 (0.187)
Education <= High School	0.034 (0.307)	-0.313 (0.249)	0.551** (0.261)	-0.248 (0.162)
Race = Non-Hispanic White	-0.170 (0.387)	-0.024 (0.315)	-0.021 (0.329)	0.263 (0.205)
Race = Non-Hispanic Black	0.044 (0.489)	-0.281 (0.397)	0.772* (0.415)	-0.024 (0.258)
Employed	-0.327 (0.310)	-0.265 (0.252)	-0.120 (0.263)	0.099 (0.164)
Female	0.053 (0.313)	-0.264 (0.254)	-0.020 (0.266)	0.514** (0.165)
Household Size	-0.106 (0.130)	0.063 (0.105)	-0.150 (0.110)	0.122* (0.069)
Age (years)	-0.009 (0.011)	-0.012 (0.009)	-0.004 (0.009)	-0.006 (0.006)
Number of Children	-0.163 (0.183)	-0.130 (0.149)	0.152 (0.155)	-0.018 (0.097)
_cons	3.823 (0.680)	8.327 (0.553)	5.356 (0.578)	8.413 (0.360)

Standard deviations are in parentheses. *p<0.1, **p<0.05, ***p<0.01

The educational intervention in this randomized control trial appears to have been ineffective at changing behavior. There is no statistically significant evidence of improvements in the fractions of higher Guiding Star Rated items being selected by clients receiving the intervention. Similarly, their nutrition index (HEI) also does not appear to be impacted by the intervention. Upon examination of the 13 HEI components, no significant evidence was found of the impact of the intervention.

CHAPTER 5. DISCUSSION & CONCLUSION

In this study, we investigate whether a brief, one-time educational intervention has effects on food pantry clients' bundle selection. The educational intervention was a nutritional ranking page on the end of the intervention group's survey with Guiding Star Ratings for non-perishable food items. The intervention was designed to improve consumers' knowledge regarding healthful eating choices with minimal commitment of time.

Results from this study found little if any response to the intervention, suggesting that an alternative educational intervention may be needed to shift clients to behavior towards selection of more healthy items. While there was not a statistically significant difference between the control and intervention groups' food bundle quality, the majority of participants in this study reported they preferred fresh fruits and vegetables, protein food items, and dairy products in comparison to grains, beverages, and non-food items. Several studies report these findings that clients prefer fresh produce, protein, and dairy, during their pantry visit (Robaina & Martin, 2013; Akobundo, Cohen, Laus, Shulte, & Soussloff, 2004). It may be that healthful dietary changes are more likely with a longer, or stronger intervention in order to determine greater effects with respect to education levels.

Findings from this study also suggest that clients' motivations and barriers affecting their decisions to visit the pantry may be more extensive than what was identified by each participant's response. The majority of survey participants indicated that the availability of nutritious foods at the food pantry was influential on their decision to visit (88% of total). Just over half of the participants reported that the quantity of food provided at the pantry influenced their decision to visit. It appears that clients intend to select healthful, nutritious items during their visit. However, it is possible that their failure to select fresh fruit, vegetable, and dairy may have been due to a lack of availability of their preferred choices on the day of their visit. Nearly half of the clients surveyed reported that the lack of available produce is a barrier to their selection of healthy foods.

Our findings suggest there are other barriers besides food availability to obtaining healthy foods from the pantry. These barriers included client transportation to and from the pantry, as well as challenges with transporting the food home. In addition, a lack of time for preparing healthy foods was also cited as discouraging selection of healthy foods. These challenges related to transportation were two of the most frequently reported barriers to visiting the pantry. Other studies

report that accessibility or geographic location are particularly important factors in determining clients' use of the food pantry (Mabli, Jones, and Kaufman, 2013; Ginsburg et. al 2018). Only twenty percent of clients surveyed indicated they did not have time for preparing healthy foods. Recent studies show that time allocated for food preparation decreased in the mid-1990s with little decrease in later years (Smith, Ng, and Popkin, 2013). They found that easily prepared convenience foods may have contributed to the decrease in food preparation time.

We observe that having at least a high school education negatively affected the overall HEI-based Nutrition Index value of client food bundles. Results from this study indicated that across the HEI component categories, high school education was significantly associated with lower intakes of total fruits, whole fruits, total vegetables, greens and beans, whole grains, and seafoods/plant proteins. This may be related to differing levels of financial or other stress in clients' lives. Further studies might help to understand the association between education levels, clients' living situations and pantry users' food bundle quality selected at choice pantries.

We also observe that age has a positive effect on bundle quality of food pantry clients in this study. This may be due to the fact that diet related diseases tend to manifest as people age. Such trends of increasing HEI scores with age have been observed in the USDA 2015-2020 Report of Dietary Guidelines (USDA, 2015b).

Our findings suggest a need for further study of the impact of financial and other stresses on client behavior. Clients with a lower frequency of pantry visits (no more than three times per year) generally had a higher Nutrition Index value for their selected food bundles. Our findings are unique in that they contradict those of similar studies that found that high frequency pantry users (clients who visit more than once per month) tend to have a higher quality diet (Liu, Zhang, Remley, Eicher-Miller, 2018). Although, we do not know the overall clients' diet quality in our study, we do know that the quality of their selected food bundles had a lower Nutrition Index score than clients who visited on a monthly/weekly base.

5.1 Research Limitations

This study presents the following limitations:

1. Survey responses were self-reported which introduces response bias. Participants could potentially answer questions in a way they feel is socially acceptable which may not align with their actual behaviors or beliefs.

2. The findings of this study may not be general. The survey work reported here focused on one food pantry in the Midwest United States over a relatively brief timespan.
3. This study did not assess client food or financial insecurity. Therefore, it is difficult to determine whether the nutrition selection behavior may be associated with a particular food or financial insecurity level.
4. As with all food pantries, the variety of items available decreases throughout the day as supplies are depleted. Food item availability data was not dynamically recorded throughout the day in this study.

5.2 Future Research

It is possible that repeated exposure to the low cost non-intrusive nudge used in this study may have a measurable impact. Future research could include a longer-term study where clients' selections are observed over multiple visits to the pantry with repeat interventions to thoroughly determine the efficacy of repetition. A standard form of the educational worksheet intervention was used throughout this study. A future study could use alternative versions of the intervention including additional information such as health outcomes from eating habits and meal preparation guides, signage near food items, and ingredient bundling information. In this manner information in relation to how intrusive a worksheet needs to be to influence client behavior in a single visit could be obtained. Also including signage and consultations may help the clients quickly identify healthy options in addition to solely recalling information from the worksheet. This may also help with learning the nutrition rating system.

Finally, a study that incorporates an educational intervention and tracks the availability of healthful nutrient dense foods at the time of selection could add to the general body of knowledge about behavioral economics and nutrition. By collecting data on both the selections and availability, it may be possible to improve our understanding of the impact of the intervention on item selection among the items available.

5.3 Conclusions

We study the effect of a nutritional ranking intervention in encouraging clients toward healthy food options during their pantry visit. This study is novel in that it tests whether a brief

educational intervention has an effect on food pantry clients' diet quality with just one brief interaction with the client. This study is also novel in that it examines the variability of items in clients' food bundles with respect to Guiding Star Ratings and HEI scores per food item. The findings from this study imply that a single, brief intervention is ineffective in changing client behavior regarding the selection of healthy foods. This suggests that a more intrusive educational intervention is needed, at a minimum, to have an impact on client selections. While clients stated that availability of nutrient-dense food items such as fresh produce is a barrier to making healthy food choices, clients also revealed that other barriers included no time to prepare healthy items, not knowing how to prepare healthy items, or not interested in selecting healthy items. This work can serve to catalyze further investigation into the potential benefits of nutrition rating systems in helping food pantry clients make healthier choices.

APPENDIX A. FOOD PANTRY ITEMS BY GUIDING STAR RATING

This table contains all the items that were both rated in this study and selected by food pantry clients. Ratings were retrieved from the Guiding Star Rating Database based on the brand of the items. The database was accessed at (<http://food.guidingstars.com/Templates/FoodFinder.aspx?word=>)

Zero Star Items		One Star Items	Two Star Items		Three Star Items	
assort_sandwich_meat	kashi_granola	bagel_blueberry	apple_juice	grapes	apples	limes_lemons
bacon_hamburger	light_apricots	bagel_everything	beef	honey_bunches_oats	applesauce	low_sodium_carrots
bacon_pizza	light_mandarin_oranges	bagel_raisin	biscuits	instant_mashed_potatoes	avocado	milk_nonfat
beef_pasta	light_syrup	chicken_pot_pie	branflakes_cereal	linguine_noodles	banana	milk_one_percent
beef_stew	low_sodium_greenbeans	light_fruit_cocktail	bread	locker_mate	bell_peppers	mushrooms
brats	macaroni_cheese	low_sodium_potatoes	cantaloupe	orange_juice	blueberries	nectarene
caesar_dressing	nilla_wafers	milk	cantaloupe	pasta_noodles	brussel_sprouts	northern_beans
cheddar_cheese	oreos	peach_orange_cereal	locker_mate	peanut_butter	buffalo_meat	oats
cheez_its	pancake_mix	pumpkin_spice_cereal	cornflakes	raisin_bran	catfish	onion
chicken_meatballs	pizza	rice	dates	rigatoni_noodles	celery	oranges
chicken_noodle_soup	raman_noodles	ritz_crackers	eggs	spaghetti_sauce	chicken	peaches
chicken_rice_soup	ravioli	special_k_apple_cereal	fresh_greenbeans	sweet_peas	cilantro	pineapple
cream_corn	can_carrots	special_k_pumpkin_cereal	fresh_mixed_fruit	tomato_juice	crushed_tomatoes	pinto_beans
cream_mushroom_soup	can_greenbeans	sweet_corn	fresh_mixed_fruit_tray	tomato_sauce	cucumber	plum
creamed_corn	rice_soy		fresh_potatoes	vegetarian_beans	fish	popcorn
diced_tomatoes	saltine_crackers		grape_juice	wheat_cereal	fresh_carrots	pork
Dippin_dots_cereal	sausage				fresh_corn	prunes
fig_newton_cookies	spaghetti_rings				fresh_cranberries	radishes
graham_crackers	spare_rib				fresh_grapefruit	raspberries
granola	stovetop_stuffing				fresh_mixed_vegetables	red_beans
gravy	strawberry_jelly				fresh_oranges	salmon
hershey_bites	teddy_grahams				fresh_peaches	shredded_chicken
honest_sport	whole_gr_saltines				fresh_salad	mushroom
					fresh_snap_peas	squash
					fresh_sweet_potato	strawberries
					fresh_tomatoes	turkey
					kiwi	unspecified_fruit
					lamb	unspecified_meat
					lemons	unspecified_vegetables
					lettuce	yams
					limes	zucchini

APPENDIX B ADDITIONAL REGRESSION MODEL RESULTS FOR HEI COMPONENTS

The following table contains additional information on the regression models run for the HEI component categories.

Appendix B Table 5.1 HEI Components as Outcome Variable in Regression Models 14-22

HEI Component Models	R-Squared Value	F-Statistic
Total Fruit	0.013	0.77
Whole Fruit	0.025	1.49
Total Vegetables	0.035	2.07
Greens & Beans	0.042	2.53
Whole Grains	0.017	1.01
Total Protein	0.029	1.74
Dairy	0.014	0.79
Seafood and Plant Proteins	0.038	2.28
Fatty Acids	0.021	1.23
Refined Grains	0.020	1.12
Sodium	0.014	0.81
Added Sugars	0.024	1.45
Saturated Fats	0.052	3.14

APPENDIX C PARTICIPANT RESPONSES

This appendix contains tables with information in relation to the client preferences for food types that they desire when they visit the pantry and the perceived barriers that the clients face to preparing healthy foods.

Appendix C Table 5.2 Type of Food or Products Desired During Pantry Visit (n=615)

Statement	Number of Respondents	Percent of Total
Desires Fresh Produce		
No	178	28.99%
Yes	436	71.01%
Desires Protein Such as Meat		
No	128	20.81%
Yes	487	79.19%
Desires Grains		
No	439	71.38%
Yes	176	28.62%
Desires Dairy		
No	211	34.31%
Yes	404	65.69%

Appendix C Table 5.3 Barriers that Might Keep Clients from Making Healthier Food Choices at the Food Pantry (n=615)

Statement	Number of Respondents	Percent of Total
Produce Not Available		
No	338	54.96%
Yes	277	45.04%
No Time to Prepare		
No	499	81.14%
Yes	116	18.86%
I Don't Know How to Prepare Healthy Food		
No	561	91.22%
Yes	54	8.78%
I Don't Like Fresh Fruit & Vegetables		
No	598	97.24%
Yes	17	2.76%
Not Interested		
No	575	93.5%
Yes	40	6.5%
Other		
No	349	71.52%
Yes	139	28.48%


APPENDIX D NUTRITION RANKING SHEET

This appendix contains an example of the nutritional ranking worksheet originally developed for this study that was given to clients in the intervention group. The worksheet varied for each day containing images of items that would be present for that day. The nutritional values of the items were denoted by guiding star ratings and the clients would select the likeliness that they would select a particular item.

NUTRITION INFORMATION SHEET

The following is the list of items available in the food pantry. Each item is rated according to its nutrient content. The higher the number of stars, the healthier the product.

Given this information how likely are you to take this item home today?

	Somewhat likely	Very likely	Not likely at all	Do not have enough information about the item
  Sliced Pears in Light Syrup				
  Premium Beef Soup				
  Macaroni & Cheese				
  Saltine Crackers				
  Sweet Corn				
  Peanut Butter				
  Beef				
  Carrots				
  Green Beans				
  Chicken				
  Pork				

REFERENCES

- Akobundu, U. O., Cohen, N. L., Laus, M. J., Schulte, M. J., & Soussloff, M. N. (2004). Vitamins A and C, calcium, fruit, and dairy products are limited in food pantries. *Journal of the American Dietetic Association*, 104(5), 811-813. doi:10.1016/j.jada.2004.03.009
- Block, G., Gillespie, C., Rosenbaum, E. H., & Jenson, C. (2000). A rapid food screener to assess fat and fruit and vegetable intake. *American Journal of Preventive Medicine*, 18(4), 284-288. doi:10.1016/s0749-3797(00)00119-7
- Caspi, C. E., Canterbury, M., Carlson, S., Bain, J., Bohen, L., Grannon, K., . . . Kottke, T. (2019). A behavioural economics approach to improving healthy food selection among food pantry clients. *Public Health Nutrition*, 22(12), 2303-2313. doi:10.1017/s1368980019000405
- Chapnick M, Barnidge E, Sawicki M, Elliott M. Healthy options in food pantries—a qualitative analysis of factors affecting the provision of healthy food items in St. Louis, Missouri. *Journal of Hunger & Environmental Nutrition* 2017;1–19. doi:10.1080/19320248.2017.1284027.
- Chrysochou, P. (2010). Food health branding: The role of marketing mix elements and public discourse in conveying a healthy brand image. *Journal of Marketing Communications*, 16(1-2), 69-85. doi:10.1080/13527260903342787
- Companion, M. (2010). Constriction in the Variety of Urban Food Pantry Donations by Private Individuals. *Journal of Urban Affairs*, 32(5), 633-646.
- Cooksey-Stowers, K., Martin, K., Schwartz, M., 2018. Client Preferences for Nutrition Interventions in Food Pantries, *Journal of Hunger & Environmental Nutrition*, DOI: 10.1080/19320248.2018.1512929
- Cooksey-Stowers, K., Read, M., Wolff, M., Martin, K. S., McCabe, M., & Schwartz, M. (2018). Food Pantry Staff Attitudes about Using a Nutrition Rating System to Guide Client Choice. *Journal of Hunger & Environmental Nutrition*, 14(1-2), 35-49. doi:10.1080/19320248.2018.1512930
- Cooksey-Stowers, K., Read, M., Wolff, M., Martin, K. S., McCabe, M., & Schwartz, M. (2018). Food Pantry Staff Attitudes about Using a Nutrition Rating System to Guide Client Choice. *Journal of Hunger & Environmental Nutrition*, 14(1-2), 35-49. doi:10.1080/19320248.2018.1512930

- Coombs, C., 2018. Promoting Client Nutrition in Urban Utah Food Pantries. M.S. Thesis. Utah State University
- Dachner N, Ricciuto L, Kirkpatrick SI, Tarasuk V. Food purchasing and Food Insecurity Among Low-Income Toronto Families. *Can J Diet Pract. Res* 2010;71(3):e50-e56.
- De Ridder, D., Kroese, F., Evers, C., Adriaanse, M., & Gillebaart, M. (2017). Healthy diet: Health impact, prevalence, correlates, and interventions. *Psychology & Health*, 32(8), 907-941.
- Duffy, P., Zizza, C., Jacoby, J., & Tayie, F. A. (2009). Diet Quality is Low among Female Food Pantry Clients in Eastern Alabama. *Journal of Nutrition Education and Behavior*, 41(6), 414-419. doi:10.1016/j.jneb.2008.09.002
- Fischer, L. M., Sutherland, L. A., Kaley, L. A., Fox, T. A., Hasler, C. M., Nobel, J., . . . Blumberg, J. (2011). Development and Implementation of the Guiding Stars Nutrition Guidance Program. *American Journal of Health Promotion*, 26(2). doi:10.4278/ajhp.100709-qual-238
- Ginsburg, Z. A., Bryan, A. D., Rubinstein, E. B., Frankel, H. J., Maroko, A. R., Schechter, C. B., . . . Lucan, S. C. (2018). Unreliable and Difficult-to-Access Food for Those in Need: A Qualitative and Quantitative Study of Urban Food Pantries. *Journal of Community Health*, 44(1), 16-31. doi:10.1007/s10900-018-0549-2
- Handforth, B., Hennink, M., & Schwartz, M. B. (2013). A Qualitative Study of Nutrition-Based Initiatives at Selected Food Banks in the Feeding America Network. *Journal of the Academy of Nutrition and Dietetics*, 113(3), 411-415. doi:10.1016/j.jand.2012.11.001
- Heath, S. (2011). Maintaining a Balanced Diet with Food Allergies. *Journal of Community Nursing*, 25(4), 22-24.
- Hilbert, N., Evans-Cowley, J., Reece, J., Rogers, C., Ake, W., & Hoy, C. (2014). Mapping the Cost of a Balanced Diet, as a Function of Travel Time and Food Price. *Journal of Agriculture, Food Systems, and Community Development*, 105-127. doi:10.5304/jafscd.2014.051.010
- Hoisington, A., Shultz, J. A., & Butkus, S. (2002). Coping Strategies and Nutrition Education Needs Among Food Pantry Users. *Journal of Nutrition Education and Behavior*, 34(6), 326-333. doi:10.1016/s1499-4046(06)60115-2
- Hoisington, Manore, & Raab. (2011). Nutritional Quality of Emergency Foods. *Journal of the American Dietetic Association*, 111(4), 573-576.

- Kennedy, E. (2008). Putting the pyramid into action: The healthy eating index and food quality score. *Asia Pacific Journal Of Clinical Nutrition*, 17(S1), 70-74.
- Kennedy, E., Ohls, J., Carlson, S., & Fleming, K. (1995). The Healthy Eating Index: Design and applications. *Journal of the American Dietetic Association*, 95(10), 1103-8.
- Krebs-Smith, Pannucci, Subar, Kirkpatrick, Lerman, Tooze, . . . Reedy. (2018). Update of the Healthy Eating Index: HEI-2015. *Journal of the Academy of Nutrition and Dietetics*, 118(9), 1591-1602.
- Liu, Y., Zhang, Y., Remley, D. T., & Eicher-Miller, H. A. (2019). Frequency of Food Pantry Use Is Associated with Diet Quality among Indiana Food Pantry Clients. *Journal of the Academy of Nutrition and Dietetics*. doi:10.1016/j.jand.2019.02.015
- Mabli, J., Jones, D., & Kaufman, P. (2013). Characterizing Food Access in America: Considering the Role of Emergency Food Pantries in Areas without Supermarkets. *Journal of Hunger & Environmental Nutrition*, 8, 310-323.
- Mabli, J., Jones, D., & Kaufman, P. (2013). Characterizing Food Access in America: Considering the Role of Emergency Food Pantries in Areas without Supermarkets. *Journal of Hunger & Environmental Nutrition*, 8(3), 310-323. doi:10.1080/19320248.2013.786663
- Marchi, E. D., Caputo, V., Nayga, R. M., & Banterle, A. (2016). Time preferences and food choices: Evidence from a choice experiment. *Food Policy*, 62, 99-109. doi:10.1016/j.foodpol.2016.05.004
- Martin, Wu, Wolff, Colantonio, & Grady. (2013). A Novel Food Pantry Program: Food Security, Self-Sufficiency, and Diet-Quality Outcomes: Food Security, Self-Sufficiency, and Diet-Quality Outcomes. *American Journal of Preventive Medicine*, 45(5), 569-575.
- Morales, M. E., & Berkowitz, S. A. (2016). The Relationship Between Food Insecurity, Dietary Patterns, and Obesity. *Current Nutrition Reports*, 5(1), 54-60. doi:10.1007/s13668-016-0153-y
- Mousa, T. Y., & Freeland-Graves, J. H. (2018). Impact of food pantry donations on diet of a low-income population. *International Journal of Food Sciences and Nutrition*, 70(1), 78-87. doi:10.1080/09637486.2018.1466271
- Nackers, L., & Appelhans, B. (2013). Food Insecurity Is Linked to a Food Environment Promoting Obesity in Households With Children. *Journal of Nutrition Education and Behavior*, 45(6), 780-784.

- Nikolova, H., & Inman, J. (2015). Healthy Choice: The Effect of Simplified POS Nutritional Information on Consumer Choice Behavior. *SSRN Electronic Journal*. doi:10.2139/ssrn.2564082
- Rivera, C., Alford, S., Isham, M., Morgan, B., Just, D., Swigert, J., Figari, R., Weber, S. 2016. The Power of Nudges: Making the Healthy Choice the Easy Choice in Food Pantries. Report
- Robaina, K. A., & Martin, K. S. (2013). Food Insecurity, Poor Diet Quality, and Obesity among Food Pantry Participants in Hartford, CT. *Journal of Nutrition Education and Behavior*, 45(2), 159-164. doi:10.1016/j.jneb.2012.07.001
- Rochester, J. S., Nanney, M. S., & Story, M. (2011). Assessing Foodshelves' Ability to Distribute Healthy Foods to Foodshelf Clients. *Journal of Hunger & Environmental Nutrition*, 6, 10-26)
- Shanks, C. B. (2017). Promoting Food Pantry Environments that Encourage Nutritious Eating Behaviors. *Journal of the Academy of Nutrition and Dietetics*, 117(4), 523-525. doi:10.1016/j.jand.2016.12.020
- Shimada, T., Ross, M., Campbell, E. C., & Webb, K. L. (2013). A Model to Drive Research-Based Policy Change: Improving the Nutritional Quality of Emergency Food. *Journal of Hunger & Environmental Nutrition*, 8(3), 281-293. doi:10.1080/19320248.2013.821963
- Siro', I., Ka' polna, E., Ka' polna, B., Lugasi, A., 2008. Functional Food. Product Development, Marketing and Consumer Acceptance: A Review. *Appetite* 51,456-467.
- Smith, L. P., Ng, S. W., & Popkin, B. M. (2013). Trends in US home food preparation and consumption: Analysis of national nutrition surveys and time use studies from 1965-1966 to 2007-2008. *Nutrition Journal*, 12(1). doi:10.1186/1475-2891-12-45
- Soo Lim. (2018). Eating a Balanced Diet: A Healthy Life through a Balanced Diet in the Age of Longevity. *Journal of Obesity & Metabolic Syndrome*, 27(1), 39-45
- Stein, E., Schwartz, M., Stowers, K., McCabe, M., & White, M. (2019). Ingredient bundles and recipe tastings in food pantries: A pilot study to increase the selection of healthy foods. *Public Health Nutrition*, 1-6.
- Thaler, R & Sunstein, C (2009) *Nudge: Improving Decisions about Health, Wealth, and Happiness*. New York: Penguin Books.

- Tran, L. T., Brewster, P. J., Chidambaram, V., & Hurdle, J. F. (2015). Towards Measuring the Food Quality of Grocery Purchases: An Estimation Model of the Healthy Eating Index-2010 Using only Food Item Counts. *Procedia Food Science*, 4, 148-159. doi:10.1016/j.profoo.2015.06.020
- Tran, L., Brewster, P., Chidambaram, V., Hurdle, J. 2017. An Innovative Method for Monitoring Food Quality and the Healthfulness of Consumers' Grocery Purchases. *Nutrients* (9) p. 457.
- U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December (2015b). Available at <https://health.gov/dietaryguidelines/2015/guidelines/>.
- U.S. Department of Health and Human Services and U.S. Department of Agriculture. Chapter 2 Shifts Needed To Align With Healthy Eating Patterns. (2015). Retrieved from <https://health.gov/dietaryguidelines/2015/guidelines/chapter-2/current-eating-patterns-in-the-united-states/>
- Verbeke, W. (2005). Consumer acceptance of functional foods: Socio-demographic, cognitive and attitudinal determinants. *Food Quality and Preference*, 16(1), 45-57.