

THE EVALUATION OF THE REVISED SPECIAL SUPPLEMENTAL
NUTRITIONPROGRAM FOR WOMEN, INFANTS, AND CHILDREN (WIC) ON
CONSUMPTION OF FRUITS AND VEGETABLES IN TENNESSEE

by

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I dedicate this research to my amazing parents, Johnny and Sue Smith. Thank you for supporting my education since 1990 when I started school at North Elementary in Savannah, Tennessee. This would not have been possible without you.

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ABSTRACT

The main purpose of this study was to examine the effect of providing cash value vouchers (CVVs) for fruits and vegetables on the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) participants' consumption of fruits and vegetables. Participants were recruited from three health departments in Tennessee. The experimental group ($n = 56$) completed a fruit and vegetable inventory to assess attitudes and a fruit and vegetable checklist to examine consumption during their initial appointment for WIC certification at the health department. The experimental group was certified for WIC services; the group completed a pretest that consisted of a checklist and inventory to determine fruit and vegetable intake during the initial WIC clinic visit. They completed the same checklist and inventory (posttest) three months later during the follow-up WIC visit to determine changes in fruit and vegetable consumption.

A modified nonequivalent control group design was used to help measure the effectiveness of the vouchers since a true control group was not available because all qualifying women will receive the CVVs. A new group of WIC participants served as the wait-list control group ($n = 37$) and completed a pretest at same time the experimental group received their posttest. The pretest for the wait-list control was the same as the pretest and posttest for the experimental group. The wait-list control group was compared with the experimental group to check for selection bias to ensure both groups were similar in demographics.

The following indexes were developed from questions on both the fruit and vegetable inventory and fruit and vegetable checklist: perceived benefit, perceived control, self-efficacy, fruit and vegetable consumption, and fruit and vegetable amount. Three questions were examined individually from the questionnaires regarding readiness to eat more fruit, readiness to eat more vegetables, and perceived diet quality.

A repeated measures ANOVA was used to compare pretest and posttest scores on fruit and vegetable consumption in the experimental group. The mean score for fruit and vegetable consumption did increase in the experimental group, however, it was not a significant increase and it cannot be attributed to the CVVs.

Key Words: Tennessee Department of Health, Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), Cash value vouchers (CVVs), Nutrition, Fruit and Vegetable Checklist, Fruit and Vegetable Inventory

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CHAPTER ONE:

INTRODUCTION

The U.S. Department of Agriculture's Food and Nutrition Service (USDA-FNS) is the Federal agency that administers food assistance programs and promotes healthy eating practices for the nation. One of the assistance programs they oversee is the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), which began in the 1970s to help reduce food insecurity and improve health by providing food, health referrals and nutrition education to low-income women, infants, and children up to age 5 years (U.S. Department Agriculture, Food and Nutrition Service, 2013a). Each month, individuals who apply and qualify for the program receive certain nutrient-dense foods. The original WIC food package consisted of whole milk, cheese, iron-fortified cereal, vitamin-C fortified fruit juice and a few protein-rich foods (U.S. Department of Agriculture, Food and Nutrition Service, 2013b; Kim, Whaley, Gradziel, Crocker, Ritchie, & Harrison, 2013).

In 1980, USDA-FNS worked with the Department of Health and Human Services (HHS) to publish the first Dietary Guidelines for Americans (DGA), that emphasize avoiding too much fat, saturated fat, cholesterol, sugar and sodium while eating foods with adequate starch and fiber; the DGA. The DGA are updated every five years to reflect current nutrition research findings. The 1985, 1985, 1990, and 2000 DGA remained similar to the original 1980 guidelines. The 2005 guidelines were the first to recommend eating whole fruits instead of

drinking fruit juice. The American Academy of Pediatrics had made a similar recommendation in 2001, and their 2017 Policy Statement is to avoid all juice for infants to age 12 months and limit it to four ounces per day for children ages one to three years and to six ounces per day for children ages four to six (Heyman & Abrams, 2017).

The 2010 DGA encourage people to limit consumption of foods high in sodium, saturated fats, *trans* fats, added sugars, and refined grains and to consume healthy items such as fruits, vegetables, whole grains, and fat-free and low-fat dairy products. One of the main reasons to encourage Americans to eat more fruits and vegetables is they are high in nutrient content relatively low in calories (U.S. Department of Health and Human Services, 2010). The 2015-2020 DGA builds from the previous edition with revisions. The majority of the current recommendations encourage Americans to choose a diet appropriate based on the overall eating pattern instead of specific food groups or nutrients (U.S. Department of Health and Human Services, 2015).

Despite recommendations from the government and health professionals, Americans do not consume an adequate amount of fruits and vegetables (Guenther, Dodd, Reedy, & Krebs-Smith, 2006; State of the Plate, 2010). Additionally, low-income populations are even less likely to consume adequate fruits and vegetables (Anderson, Bybee, Brown, McLean, Garcia, Breer, & Schillo, 2001; Cassady, Jetter, & Culp, 2007; Kropf, Holben, Holcomb, & Anderson, 2007). As much as 19% of low-income households spend zero dollars on produce (Blisard, Stewart, & Jolliffe, 2004). Cassady, Jetter, & Culp

(2007) report that families would need to devote 43% to 70% of their food budget on fruits and vegetables to meet the dietary recommendations.

WIC food packages needed to be updated to comply with the 2005 DGAs and infant feeding practice guidelines of the American Academy of Pediatrics. All states were required to implement these changes by October 1, 2009 (U.S. Department Agriculture, Food and Nutrition Service, 2013b). For women and children ages one to five, WIC food packages are healthier than before and the revised WIC package now includes lower fat dairy items as well as whole fruits and vegetables instead of juice (Kim et al., 2013).

The revision of the WIC food packages was a monumental change for the supplemental nutrition program and detailed research needs to be conducted on the program changes. Although these changes are relatively new, the history of the program has shown little change in foods offered and there is limited research on the revised food packages. The updated food packages provide less fat, saturated fat, and simple carbohydrates than the package previously contained. Also, fruits and vegetables are now available through cash value vouchers (CVVs) for women and children (Kim et al., 2013).

Food insecurity can occur if family members are habitually concerned about their ability to afford nutritionally adequate and safe foods or if an adult family member occasionally skips meals (Alaimo, Olson, & Frongillo, 2001; Seligman, Laraia, & Kushel, 2009). Food insecurity can impair nutritional status and is negatively associated with health status. Food assistance programs aim to alleviate dietary and health issues that are a result of food insecurity (Kropf et

al., 2007). In fact, WIC is one example of a USDA-FNS program designed to help alleviate food insecurity. WIC provides foods, health care referrals, and nutrition education for low-income pregnant and postpartum women, infants, and children up to age five (U.S. Department of Agriculture, Food and Nutrition Service, 2013a). Increasing fresh fruit and vegetable consumption is recommended for Americans (U.S. Department of Agriculture, Food and Nutrition Service, 2013a). However, many homes are faced with food insecurity and cannot afford fresh fruits and vegetables (Alaimo et al., 2001; Kropf et al., 2007). WIC is one program that aims to protect the nutrition status and health of women, infants, and children (U.S. Department of Agriculture, Food and Nutrition Service, 2013a).

Limitations

This research has several limitations that should be noted. This study only includes WIC participants in Tennessee at participating health departments. Since the revisions have already been implemented to the WIC food package, this study only involves prenatal mothers that were initially certified eligible-to participate in the WIC program. A true control group was not be available due to all eligible WIC participants receiving CVVs for fruits and vegetables with the revised food package, thus a nonequivalent control group design was used. This study only focused on fruits and vegetables and not the other components of the revised WIC food package.

Research Need

Food assistance programs, such as WIC, have been established to improve dietary and health issues in the United States (Kropf et al., 2007 and U.S. Department of Agriculture, Food and Nutrition Service, 2013a). WIC provides many benefits to those that participate such as healthy foods and nutrition education for low-income pregnant and postpartum women, infants, and children up to age five (U.S. Department of Agriculture, Food and Nutrition Service, 2013a). WIC modified the food packages offered in 2009, and the revised food package now includes fruits and vegetables for women and children (Kim et al., 2013).

Research is needed on the revised food package and specifically the fruit and vegetable component of the foods available from WIC packages. This study focuses only on mothers who receive the revised WIC food package and will specifically focus on fruits and vegetables. Valid and measurable data on the impact of the changes made by the U.S. Department of Agriculture's Food and Nutrition Service (USDA-FNS) and mothers affected by the WIC program shifts is imperative for gauging nutritional affects. The results from this study may be used to predict the program changes' success and also as valuable feedback for WIC Nutritionists, Local Health Departments, Public Health County Directors, and State WIC Directors. This study may support the benefits of the WIC program if it shows an increase of fruit and vegetable consumption among participants after having access to the revised food package in the WIC program and also may be replicated elsewhere to add to the body of research in this field.

The purpose of this study was to examine the effect of providing CVVs on WIC participants' consumption of fruits and vegetables in Tennessee. The following hypothesis is tested in this study: WIC participants who receive a CVV for fruits and vegetables will consume more fruits and vegetables than WIC participants who do not receive a CVV-for fruits and vegetables. We controlled for race, age, income, education, pregnancy status, number of children, pre-test consumption of fruits and vegetables, and pre-test attitude about fruits and vegetables.

Data were collected from July to November 2014. The experimental group completed their pretest during the months of July and August and the experimental group completed a posttest at their second visit to the health department three months later which was in October and November. The waitlist control also completed their pretest during the months of October and November.

The following definitions are provided to clarify the program and materials in this study and the different types of group assignment and program in this research.

Cash value vouchers (CVVs): a component of the revised WIC package (\$6 for each child per month and \$10 for the woman per month in 2014) that can only be used for fresh, canned, or frozen fruits and vegetables (Whaley et al., 2012).

Experimental group: WIC clients at participating local health departments that were given a pretest prior to receiving WIC services including CVVs at their

initial certification appointment and then given a posttest three months after receiving WIC services at their second visit at the health department.

Wait-list control group: WIC clients at participating local health departments that were given a pretest at the same time the experimental group received their posttest.

Women, Infants, and Children (WIC): a federal program that provides a variety of services to low-income pregnant and postpartum women, and to infants and children up to age five including foods, health care referrals, and nutrition education (U.S. Department of Agriculture, Food and Nutrition Service, 2013a).

CHAPTER TWO: LITERATURE REVIEW

The Supplemental Nutrition Program for Women, Infants, and Children (WIC) is a program intended to alleviate food insecurity and help meet the vulnerable population the program serves population meet the dietary recommendations (U.S. Department of Agriculture, Food and Nutrition Service, 2013a). Several revisions were made to the foods offered through the WIC program in recent years. For example, food packages include only lower-fat dairy products such as skim, 1%, or 2% milk for all women and children ages two to five as opposed to full-fat dairy products in the previous food packages. Cheese, eggs, 100% juice, breakfast cereal, and beans or peanut butter continue to be offered in the revised package; however, cheese, eggs, and juice are offered in reduced amounts compared to the original food package. The other major change in the revised package is the cash value voucher (CVV) for fruits and vegetables for fresh, canned, or frozen fruits and vegetables. Research on WIC participants has traditionally examined the previous food package and focused on impact of the program enhancements (Whaley et al., 2012). The purpose of this study is to examine the effect of providing CVVs for fruits and vegetables on Tennessee WIC participants' consumption of fruits and vegetables.

Studies show that many Americans do not consume the recommended amounts of fruits and vegetables (Guenther et al., 2006; State of the Plate,

2010). Goals and objectives for Healthy People 2020 include consuming more fruits and vegetables and increasing the variety of types of vegetables (U.S. Department of Health and Human Services, Healthy People 2020, 2013).

Dietary Recommendations and Adherence

Food guides have been used by nutritionists since the 1920s as a teaching tool for the general public to plan adequate diets and make the right food choices (King, Cohenour, Corruccini, & Schneeman, 1978). When WIC became a permanent nutrition program in the U.S. in 1974, (U.S. Department of Agriculture, Food and Nutrition Service, 2013a) the Basic Four Food Groups were the dietary recommendations from USDA-FNS. The Basic Four Food Groups suggested that people should consume four ½ cup servings of fruits and vegetables (King, Cohenour, Corruccini, & Schneeman, 1978).

The Food Guide Pyramid (1992-2005) was one of the most recognized and influential food guides in history. It was adopted and used by nutrition educators, teachers, the food industry, and nutrition programs. Many Americans were familiar with this iconic graphic. Qualitative research revealed that main concepts of the food guide were understood, but specific knowledge about it was somewhat limited by the general public (U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, 2011).

Thus, in 2005 MyPyramid was introduced to the public and the goal was to continue using the same familiar pyramid shape, but introduce new and personal messages to consumers (U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, 2011). Among other changes, MyPyramid differed from

the Food Guide Pyramid in that more fruits and vegetables were recommended. MyPyramid also included specific amounts of vegetables such as dark green vegetables, orange vegetables, and legumes. Additionally, MyPyramid included recommended meal plans specific to 12 different energy levels between 1000 and 3200 calories (Guenther et al., 2006).

Consumers became confused because some people adapted MyPyramid and others kept using the Food Guide Pyramid, or the “old Pyramid.”

Simultaneously MyPyramid was widely criticized for being called too simplistic by some and simultaneously and also too complicated according to other critics. A plate was identified as a possible new image to replace the pyramid due to its association with eating and to demonstrate to the public how to build a healthy meal (U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, 2011). In June 2011, MyPlate replaced MyPyramid as the government’s food symbol for healthy eating. It is a simple visual cue to help consumers develop healthy meals and it is consistent with 2010 DGAs (Academy of Nutrition and Dietetics, 2013).

Recommendations from the Dietary Guidelines for Americans (DGA) are intended for Americans ages two years and over and are additional nutritional guidelines. The DGA encourage Americans to focus on eating a healthful diet that focuses on foods and beverages that help achieve and maintain a healthy weight, promote health, and prevent disease. The first edition of the DGA was released in 1980 and was mandated in Section 301 of the National Nutrition Monitoring and Related Research Act of 1990 (7 U.S.C. 5341) to be reviewed,

updated, and published every five years in a joint effort between the U.S. Department of Health and Human Services (HHS) and the USDA-FNS (U.S. Department of Health and Human Services, 2014).

For many years USDA-FNS has developed and disseminated information for healthy eating for Americans based on scientific evidence. A major revision took place between 2000 and 2005, which included the release of the 2005 DGA and were more closely aligned with the then-current MyPyramid Food Guidance System (Britten, Cleveland, Koegal, Kuczynski, & Nickols-Richardson, 2012). In 2010 the DGA focused on the following overall guidelines for healthy lifestyles which emphasized three major goals for Americans: 1) balance calories with physical activity to manage weight; 2) consume more fruits, vegetables, whole grains, fat-free and low-fat dairy products, and seafood; 3) consume fewer foods with sodium, saturated fats, trans fats, cholesterol, added sugars, and refined grains (U.S. Department of Health and Human Services, 2010).

The 2010 DGA have more specific nutritional information in the USDA-FNS Food Patterns, and some general principles that were used from previous dietary recommendations. Appropriate energy levels were detailed, nutrition goals were determined, food groupings were modified as needed, nutrient contributions from each food group were established, and daily patterns were created by adjusting food groups to ensure nutritional groups were met within the caloric limitations (Britten et al., 2012).

Food groups that were used in 2005 were reviewed and the five major food groups were retained – Fruits, Vegetables, Grains, Meat and Beans, and

Milk. The Meat and Beans Group was changed to Protein Foods Group and the Milk Group was changed to the Dairy Group to include other foods in each category. There were no changes made to the Fruit Group. There was one interesting modification in 2010 to the Vegetable Group. Previously, the 2005 Food Patterns included five subgroups of the Vegetable Group: Beans and Peas, Starchy Vegetables, Dark Green Vegetables, Orange Vegetables, and Other Vegetables. The most significant change for the 2010 DGA was the creation of the Red and Orange Vegetable subgroup. This new subgroup was developed by moving tomatoes and red peppers from the Other Vegetable subgroup to what was previously called the Orange Vegetable subgroup. The Red and Orange Vegetable subgroup encouraged a more even distribution of total vegetable consumption across the different subgroups and placed more focus on tomatoes due to both their popularity and their nutrition composition. Tomatoes constitute almost 22% of total vegetable consumption in the United States (Britten et al., 2012).

There are three primary reasons dietary guidelines encourage Americans to eat more fruits and vegetables. First, vegetables and fruits are filled with a wide variety of nutrients that are consumed in small quantities in the United States, including the following: folate, magnesium, potassium, dietary fiber, and vitamins A, C, and K. Deficiencies in these nutrients are of health concerns for the general public. Some of these concerns are for a specific group such as folic acid for women who are pregnant or may become becoming pregnant. Secondly, consumption of vegetables and fruits is associated with reduced risk of

many chronic diseases. Research suggests that consuming at least two and a half cups of vegetables and fruits per day is associated with a reduced risk of cardiovascular disease (U.S. Department of Health and Human Services, 2010). MyPlate currently recommends women ages 19-30 years of age consume two cups of fruits (U.S. Department of Agriculture, Choose MyPlate, 2017a) and two and a half cups of vegetables daily (U.S. Department of Agriculture, Choose MyPlate, 2017b). Additionally, some vegetables and fruits have been linked to protection against certain types of cancer. Third, most vegetables and fruits are naturally relatively low in calories when consumed raw or prepared with healthy cooking methods with minimal ingredients (U.S. Department of Health and Human Services, 2010).

Since the 1990 National Monitoring and Related Research Act states that dietary guidelines and information are reviewed and updated every five years, the *2015-2020 Dietary Guidelines* were released in January 2016. The *2015-2020 Dietary Guidelines* version builds from the previous edition with revisions based on the Scientific Report of the 2015 DGA Advisory Committee and consideration of both the Federal agency and public comments. Previous versions of the DGA focused on specific food groups or nutrients, but the majority of the current recommendations encourage Americans to choose a diet appropriate for them based on the overall eating pattern (U.S. Department of Health and Human Services, 2015).

There are five overarching guidelines that are intended to demonstrate to individuals that healthy eating does not have to be a strict diet, but instead

healthy eating is simply a healthy lifestyle that is adaptable for everyone to follow and still adhere to personal and culture preferences and budget limitations. The DGA are as follows:

- 1) Follow a healthy eating pattern across the lifespan.
- 2) Focus on variety, nutrient density, and amount.
- 3) Limit calories from added sugars and saturated fats and reduce sodium intake.
- 4) Shift to healthier food and beverage choices.
- 5) Support healthy eating patterns for all.

Key recommendations from the DGA include a healthy eating pattern that consists of a variety of vegetables from the subgroups that were previously established in previous recommendations and include the following: dark green, red and orange, legumes (beans and peas), starchy, and other. Whole fruits, whole grains, fat-free or low-fat dairy, a variety of protein foods, and oils can all be included in a healthy eating pattern. A healthy eating pattern should limit saturated and *trans* fats, added sugar, and sodium based on the recommendations from the 2015-2020 *Dietary Guidelines* (U.S. Department of Health and Human Services, 2015).

Fruit and vegetable consumption is included as part of the objectives for nutrition and weight status in Healthy People 2020. One objective is to increase the contribution of fruits to the diets of the population aged two years and older. The current baseline is 0.5 cup equivalent of fruits per 1000 calories aged two years and older, and the target of 0.9 cup equivalent of fruits per 1000 calories

has been established. The objectives for vegetables include both increasing the amount of vegetables consumed and increasing the variety of vegetables. The current baseline is 0.8 cup equivalent of total vegetables per 1000 calories for the mean daily intake by persons aged two years and older and the new target is 1.1 cup equivalent per 1000 calories. The objective is to increase the amount of dark green or orange vegetables or legumes consumed by person aged two years and older. The baseline is currently 0.1 cup equivalent of dark green, orange vegetables, or legumes per 1000 calories for the mean daily intake by persons aged two years and older. The target has been established for 0.3 cup equivalent of dark green, orange vegetables, or legumes per 1000 calories (U.S. Department of Health and Human Services, Healthy People 2020, 2013).

Despite the fact that there is evidence to support the health benefits of consuming fruits and vegetables, many Americans do not follow the recommendations (Guenther et al., 2006; State of the Plate, 2010). For example, when assessing data from National Health and Nutrition Examination Survey (NHANES) to see if Americans consumed the 5 A Day recommendation of fruits and vegetables, only 40% \pm 2% met this guideline. The subgroup that consumed the lowest percentage was girls between four and eight years of age (10% \pm 3%) and the highest percentage was men between 51 to 70 years of age (60% \pm 4%). When analyzing the same data in conjunction with more current recommendations of total cups per day for both fruits and vegetables, only 0.7% \pm 0.4% of boys aged 14 to 18 years met their recommendation of 5 cups total per day. The largest percentage meeting the guidelines (48% \pm 4%) was the

subgroup of children aged two to three years, whose combination of fruits and vegetables equals 1 cup per day (Guenther et al., 2006).

Produce for Better Health (PBH) is a non-profit 503 (c) (3) organization that provides educational materials to motivate people to eat more fruits and vegetables to improve public health. PBH states that the average person consumes only 1.8 cups of fruit and vegetables per day. Specifically, vegetables account for 60% of the average fruit and vegetable consumption and fruits account for 40% of daily fruit and vegetable consumption (State of the Plate, 2010). After a brief rise thru 2009, fruit and vegetable consumption per capita has declined 7% over the past five years, which has been primarily been driven by decreased consumption of vegetables (-7%) and fruit juice (-14%). Vegetables have declined in side dishes at dinner and fruit juice consumption has been reduced at breakfast (State of the Plate, 2015).

Results from the National Health Interview Survey (NHIS) also reiterate the problem that Americans are not consuming recommended amounts of fruits and vegetables. Intake estimates for fruits and vegetables, fiber, and percentage of energy by various demographic and behavioral characteristics were used in this study. Generally, intakes of the outlined dietary factors were closer to recommendations among individuals that were well-educated, engaged in other healthful behaviors, and underweight or normal weight. Latinos had higher intakes of fruits and vegetables (men: 6 servings; women: 4.8 servings) than did non-Latino Whites (men: 5.4 servings, women: 4.5 servings) and non-Latino

Blacks (men: 5.4 servings, women: 4.4 servings) (Thompson, Midthune, Subar, McNeel, Berrigan, & Kipnis, 2005).

In 2000 the Multifactor Screener in the NHIS in conjunction with NHANES was used to assess intakes of fruits and vegetables, fat, and fiber. The results show that in general intakes of these dietary factors were closer to recommendations among underweight and normal weight individuals, well-educated individuals, and those engaged in other healthful behaviors (Thompson et al., 2005).

While almost all demographics are consuming fewer vegetables (the exception is teens and adult males ages 18-34) and less fruit juice, some population segments are consuming more fruit. Children of all ages are consuming more fruit at all meals especially berries, bananas, apples, and oranges. Adults ages 18-44 are eating more fruit at breakfast. African Americans, Hispanics, and those in the West North Central, Mountain, and Pacific are eating more fruit. Households with annual incomes of either \$20,000 – \$40,000 or of \$60,000 are also eating more fruit (State of the Plate, 2015).

Fruit and Vegetable Impact on Disease

Consumption of vegetables and fruits is associated with reduced risk of many chronic diseases (U.S. Department of Health and Human Services, 2010). An article published in the *Journal of the American Dietetic Association* in 1996, which has been cited over 2500 times, explored the relationship between fruits and vegetables and cancer prevention in great detail by summarizing various studies on this topic. Both cohort studies and case-control studies were

analyzed to suggest that fruits and vegetables are protective against cancer. The cohort study evidence showed an inverse relationship between fruit and vegetable consumption and lung cancer. Case control studies revealed significant inverse associations for one or more vegetables and/or fruit categories for cancer at the following sites in the body: stomach, esophagus, lung, oral cavity and pharynx, rectum, bladder, cervix, endometrium, and larynx (Steinmetz & Potter, 1996).

In addition to analyzing fruits and vegetables generally in regards to cancer, Steinmetz & Potter (1996) also explored benefits of specific vegetables. Vegetables in general and raw vegetables showed a positive protective factor against cancer in 85% of the studies. Certain vegetables such as allium vegetables (onions, garlic, scallions, leeks, and chives), carrots, green vegetables, cruciferous vegetables (broccoli, cauliflower, brussel sprouts and cabbage) and tomatoes showed a protective association against cancer in 70% of the studies reviewed.

Steinmetz & Potter (1996) also detailed specific substances found in fruits and vegetables that may be potentially anticarcinogenic. Cruciferous vegetables are important due to their high content of dithiolthiones and isothiocyanates, which have been shown to be helpful in the detoxification of carcinogens and other compounds. Allium vegetables have diallyl sulfides and allyl methyl trisulfide, which also induce enzymes involved in detoxification of carcinogens. Fruits and vegetables are rich in antioxidants, which protect against free radicals, and thus have been implicated in protection from cancer. Vitamin C is also an

antioxidant that is found in citrus fruits. Orange fruits and vegetables such as sweet potatoes, pumpkins, papayas, and mangoes are rich sources of the antioxidant beta carotene and green leafy vegetables contain the antioxidant lutein. Many other anticarcinogens are prevalent among a variety of fruits and vegetables such as selenium, Vitamin E, flavonoids, and dietary fiber (Steinmetz & Potter, 1996).

Many different types of fruits and vegetables may reduce the risk for coronary heart disease. Participants' diets from the Nurses' Health Study and the Health Professionals Follow-Up Study were assessed in detail in a study published in 2001. The results of this study show an inverse association between fruit and vegetable intake and risk for coronary disease in both men and women. Specifically, intake of green leafy vegetables and vitamin C-rich fruits and vegetables was inversely related to risk for coronary heart disease (Joshi et al., 2001).

The association between fruit and vegetable consumption and peripheral artery disease is not as widely recognized as coronary heart disease and stroke. A large community sample was used and only 29.2% three or more servings of fruits and vegetables per day. Increasing age, increasing income, female, white, never smoking, currently married, physical activity, and frequent consumption of fish, nuts, and red meat were positively associated with daily consumption of fruits and vegetables. Participants that reported a daily intake of three or more servings of fruits and vegetables had 18% lower odds of peripheral artery

disease than those reporting less than monthly consumption (Heffron, Rockman, Adelman, Gianos, Guo, Xu & Berger, 2017).

Another study evaluated a fruit and vegetable prescription program on hemoglobin A1C, blood pressure, and weight in low income diabetics. The program allocated up to \$40 (\$10 per week for up to four weeks) to purchase produce from a farmers market in Detroit, MI. The results of the study showed a significant decrease in hemoglobin A1C in diabetics after participating in the fruit and vegetable program, but no change in weight and blood pressure (Bryce et al., 2017).

Maternal Nutrition

Proper nutrition is essential for pregnant women (Hanson et al., 2015; (Wu, Bazer, Cudd, & Spencer, 2004). Maternal nutrition is an extremely important public health issue because it impacts future generations in addition to women's health. Poor nutrition habits in adolescent girls and young women can compromise reproductive health and increase risks of adverse pregnancy outcomes for both the mother and child. Establishing healthy nutritional habits at an early age, specifically in adolescent girls and young women, can set an excellent example for optimal periconceptional health and will promote normal fetal growth and development if maintained throughout pregnancy. The health of the next generation will benefit through proper maternal nutrition by a reduced risk of obesity, diabetes mellitus, cardiovascular disease, some types of cancer, asthma, bone and joint disease, and some mental illness. A sufficient diet that provides all essential micronutrients and macronutrients will help to ensure

optimal health for adolescent girls and young women, and will equip them for future motherhood (Hanson et al., 2015).

Proper nutrition is critical for pregnant women and improper nutrition during pregnancy can alter the fetal genome and could present lifelong consequences. Placental and fetal growth is most vulnerable to the nutrition status of the mother during the first trimester of pregnancy. Under-nutrition during this time can impair fetal growth (Wu, Bazer, Cudd, & Spencer, 2004). Under-nutrition is typically associated with inadequate intake because of food shortage or food insecurity. Under-nutrition also can be a result from increased nutritional requirements or losses, or a limited ability to absorb nutrients properly (Hanson et al., 2015). Over-nutrition, defined as the consumption of excess calories, during pregnancy can also impair fetal growth during the first trimester of pregnancy (Wu, Bazer, Cudd, & Spencer, 2004). Maternal obesity increases the risk hypertensive disorders of pregnancy, gestational diabetes, and obstructed delivery for the mother. Risks for the fetus include high blood glucose, neonatal hypoglycemia, congenital anomalies, preterm birth, stillbirth/infant death, and development of childhood obesity (Hanson et al., 2015).

The ratio of macronutrients in the diet should not change in pregnancy unless nutrition was poor prior to pregnancy. Energy intake in the beginning of pregnancy should not increase, but efforts should be made to eat nutrient dense foods instead of simply eating more food. Increased caloric intake is necessary for later in pregnancy to make up for energy deposited in maternal and fetal

tissues. Specifically protein needs increase for the formation of these tissues and placenta. The total amount of fat in the diet is usually sufficient for pregnant women, but efforts should be focused on limiting saturated fat and increasing polyunsaturated fats. Consuming oily fish can help ensure pregnant women meet their requirement for polyunsaturated fat, but they should also avoid large predatory fish such as swordfish, tuna, king mackerel that could high in mercury. Complex carbohydrates with a low glycemic index are recommended and pregnant women should avoid excess sugar in their diet. Pregnant women following a diet that is rich in low glycemic index foods have less excessive gestational weight gain. It is recommended to consume 28 grams of fiber daily during pregnancy to reduce constipation and it may help reduce the risk of gestational diabetes and pre-eclampsia (Hanson et al., 2015).

Many micronutrients and vitamins are very important for proper prenatal nutrition. Both folate and vitamin B12 are required for protection against neural tube defects early in pregnancy and supplements taken prior to conceiving are recommended to be continued during pregnancy. Folate, vitamin B12, and choline work together and can have long-lasting effects on the child's health if not available in sufficient supply in the maternal diet. Vitamin D is needed in pregnancy for immune and nervous system function, and fetal skeleton development. Vitamin A is needed to ensure the visual and immune systems function properly, and for reproduction function. Excess or deficiencies in Vitamin A can cause birth defects usually involving abnormal development of the eyes, skull, lungs, and heart. Iron deficiency in pregnancy is associated with

increased risk of low birth weight and preterm delivery. The requirement for iron during pregnancy increases more than any other nutrient. Calcium supplementation has been linked to decreasing the risk of developing hypertensive disorders during pregnancy. Iodine, selenium, and zinc are all needed in the diet for fetal growth (Hanson et al., 2015).

Given the importance of maternal nutrition, MyPlate developed a Daily Food Plan specifically for prenatal mothers. Pregnant women can use the tools on the website to develop a meal plan tailored to their specific nutritional needs. Fresh, frozen, canned, and dried fruits and vegetables that high in are high in vitamin A and potassium are encouraged as healthy food choices for pregnant women (U.S. Department of Agriculture, Choose MyPlate, 2013). WIC was developed on the foundation that early intervention programs during critical times of growth and development can help prevent medical and developmental problems (Oliveira, Racine, Olmsted, & Ghelfi, 2002).

Food Insecurity

Food insecurity is defined as the state in which family members are often concerned about their ability to purchase foods that are nutritious and safe or if an adult family member occasionally skips meals (Alaimo et al., 2001; Seligman et al., 2009). Rural households and those with children under the age of six are particularly at risk to experience food insecurity. Also, adult women in food-insecure homes consume less fruits and vegetables, which can lead to an increased risk of developing chronic diseases (Kropf et al., 2007).

Income constraints inhibit spending on fruits and vegetables among low-income households. Even if low-income households receive an increase in income, research suggests that it will not likely cause them to spend more on fruits and vegetables (Stewart, Blisarrrd, & Jolliffe, 2003). Specifically, households need to budget accordingly to be able to increase their fruit and vegetable consumption (Cassady, Jetter, & Culp, 2007). There are other factors to consider for those spending less on fruits and vegetables other than income such as taste preferences for other foods, and time and effort required to prepare fruits and vegetables (Stewart et al., 2003).

Data were analyzed from NHANES to determine whether food insecurity is associated with chronic diseases. The study showed associations between food insecurity and hypertension, and food insecurity and hyperlipidemia. Seligman et al., (2009) suggest that health policies should be focused on the ability to afford high-quality foods for adults with or at risk of developing chronic diseases. The Thrifty, Low-Cost, Moderate-Cost, and Liberal Food Plans are each designed by USDA-FNS to represent a nutritious diet at a different price level. Specifically, the Thrifty Food Plan is the basis for Supplemental Nutrition Assistance Program (SNAP) allotments (United States Department of Agriculture, Center for Nutrition Policy and Promotion, 2013). Cassady, Jetter, & Culp (2007) examined the price of The Thrifty Food Plan and 2005 DGAs market basket for fruits and vegetables. The results show that a low-income family would need to devote 43% to 70% of their food budget on fruits and vegetables in order to meet the then current 2005 DGA.

Supplemental Nutrition Program for Women, Infants, and Children (WIC)

Food assistance programs are designed to improve dietary and health issues that are a result of food insecurity (Kropf et al., 2007). WIC is a supplemental nutrition program intended to alleviate food insecurity. WIC provides a variety of services to low-income pregnant or postpartum women, and to infants and children up to age five including foods, health care referrals, and nutrition education. WIC became a permanent nutrition program in the U.S. in 1974 (U.S Department of Agriculture, Food and Nutrition Service, 2013a). The WIC program was established during a time of concern of malnutrition among low-income mothers and children (Oliveira, Racine, Olmsted, & Ghelfi, 2002).

Most states provide vouchers that participants use at authorized vendors. There are approximately 46,000 merchants nationwide that accept WIC vouchers (U.S. Department of Agriculture, Food and Nutrition Service, 2013a), with over 900 authorized grocery stores and pharmacies that accept WIC vouchers (Tennessee Department of Health, Women, Infants, and Children, 2016). In Tennessee, clients are provided three months of vouchers for the appropriate food package. The clients use these vouchers to purchase foods for the prescribed food package for the next three months and then return to health department to obtain vouchers for the following three months and WIC services.

WIC has been proven effective in improving the health of a vulnerable population of pregnant women, new mothers, and their infants. Women who participated in WIC during their pregnancies had lower Medicaid costs for themselves and their babies when compared to women who did not participate in

the WIC program. Additionally, WIC participation has been linked with longer gestation periods for mothers, higher birth weights of infants, and a decrease in infant mortality (U.S Department of Agriculture, Food and Nutrition Service, 2013a). Funding for the WIC program has increased due to congressional support since there is a high rate of return for its investment. Additional funding combined with cost-containment practices have allowed more people to participate in this federal supplemental program (Oliveira, Racine, Olmsted, & Ghelfi, 2002).

The WIC Farmers' Market Nutrition Program (FMNP) is an optional component of the WIC program for which some counties participate if funding is available. In the state of Tennessee the Department of Health selects the counties to receive funding. This additional component of WIC was established by Congress in 1992 to provide vouchers for fresh fruits and vegetables to WIC participants, and to expand the awareness of farmers' markets. If a woman, infant (over four months old), and child are certified to receive WIC benefits or are on a waiting list for WIC certification, they are all eligible to participate in the WIC FMNP. Enrollees in participating WIC FMNP counties have access to a variety of fresh, unprepared, locally grown fruits, vegetables, and herbs purchased with vouchers or coupons at farmers' markets (U.S. Department of Agriculture, Food and Nutrition Service, 2013c).

The WIC FMNP is truly a partnership between local government and the Federal government, which pays for 70% of the administrative costs and local governments are responsible for the remaining 30%. USDA-FNS provides 100%

of the cost for the WIC FMNP, up to \$30 per participant each year (U.S. Department of Agriculture, Food and Nutrition Service, 2013d). Local governments selected by the state to participate can determine how the program will be administered at their level.

The Tennessee Department of Health provides WIC services in approximately 140 county health department locations and hospitals throughout the state. The WIC program in Tennessee serves about 165,000 eligible participants each month across the state. Participants must be residents of Tennessee, meet the gross income guidelines, and be determined to be at nutritional or medical risk in order to qualify for benefits. Supplemental food vouchers and CVVs for fruits and vegetables are issued to participants on the WIC program after certification and these can be used to purchase approved food items (Tennessee Department of Health, Women, Infants, and Children, 2016).

Revised WIC Food Packages

The Institute of Medicine (IOM) of the National Academies established a committee in 2004 of nutrition experts that reviewed the WIC program in great detail and then released a report with specific recommendations to enhance the program; their report came out in 2006 and all state agencies were required to implement the revisions by October 1, 2009 (U.S. Department of Agriculture, Food and Nutrition Service, 2013b). The original WIC food package for women with children included full-fat milk, eggs, breakfast cereal, 100% juice, and beans or peanut butter. The only significant change since WIC's inception occurred in

1992 when WIC was trying to encourage breastfeeding among women. Carrots and canned tuna were added to their package and increased amounts of juice, cheese, and protein food. The changes recommended by the IOM brought the foods provided in alignment with the 2005 DGA and infant feeding practice guidelines of the American Academy of Pediatrics.

One of the most monumental changes for the revised packages is a CVV for fresh, canned, or frozen fruits and vegetables. Initially only \$6 of CVV was allotted for each child per month and \$10 for women; this amount is projected to increase with the cost of living. Other changes are that cheese, eggs, and juice are offered in a reduced amount than previous packages to comply with dietary recommendations and help keep costs neutral. The food packages for all women and for children ages two to five include only lower-fat milk such as skim, 1% or 2% milk and the total amount of milk included has been reduced slightly (Whaley et al., 2012).

The IOM committee considered dietary and health data on low-income women, infants, and children; nutritional guidance from the Dietary Reference Intakes and the DGA; current dietary guidance for feeding infants and young children, and public comments from stakeholders to determine if redesigning the program could help participating families have a healthier diet. The following criteria were used to revise the food package:

- 1) The package reduces the prevalence of inadequate and excessive nutrient intakes in participants.

- 2) The package contributes to an overall dietary pattern that is consistent with the Dietary Guidelines for Americans for individuals 2 years of age and older.
- 3) The package contributes to an overall diet that is consistent with established dietary recommendations for infants and children less than 2 years of age, including encouragement of and support for breastfeeding.
- 4) Foods in the package are available in forms suitable for low income persons who may have limited transportation, storage, and cooking facilities.
- 5) Foods in the package are readily acceptable, widely available, and commonly consumed; take into account cultural food preferences; and provide incentives for families to participate in the WIC program.
- 6) Foods proposed consider the impacts that changes in the package will have on vendors and WIC agencies (The National Academies of Sciences, Engineering, Medicine, 2015).

The IOM report *WIC Food Packages: Time for a Change* recommends revisions to the food packages that will match current dietary guidelines for infants and young children, encourage consumption of fruits and vegetables, focus on whole-grains, decrease saturated fat, and appeal to a varied population. Juice would be replaced by baby food fruits and vegetables to provide more nutritionally complete and developmentally appropriate foods. Infants are fully breast-fed would receive baby food meat to provide iron and zinc that are easily

absorbed and utilized in the body (The National Academies of Sciences, Engineering, Medicine, 2015).

Families at all income levels should provide more fruits and vegetables to their children to encourage a healthy eating pattern. The IOM recommends that food packages include baby food fruits and vegetables for older infants, and CVVs for children and women to help low-income women accomplish this goal. These CVVs would offer an opportunity for low-income families to purchase a wide variety of produce. Also canned, dried, or frozen fruits and vegetables would be allowed to be purchased with these CVVs (The National Academies of Sciences, Engineering, Medicine, 2015).

The IOM concluded that the revised WIC food packages provide supplemental amounts of most food groups, provide at least 50 percent of most priority nutrients, and align with the current DGA. Cultural and ethnic preferences are enhanced since the policy revisions. The foods offered in the new packages, including the CVVs, aid in increasing consumption of fruits, vegetables, whole-grains, and seafood. Based on the reviews from this particular committee, the revisions can be expected to improve the attractiveness of the WIC program, promote breastfeeding, and safeguard the health of all WIC participants (The National Academies of Sciences, Engineering, Medicine, 2017).

Although the WIC program has been in place since the 1970s and there is a wealth of knowledge available on its benefits, research is limited on the recent revisions of the WIC food packages and specifically the CVVs. One of the first reports to be published was survey of a large cross-sectional sample of WIC

families via telephone before and after the changes to the food package in California. They found that the proportion of families eating more vegetables compared to 6 months previously was significant, but the proportion of families eating more fruit compared to 6 months previously did not significantly change. The mean frequency of fruit intake by respondents was significant and equated to an increase of about 0.1 servings of fruit per day and the mean frequency of vegetable intake by respondents was unchanged after the revised WIC package (Whaley et al., 2012).

In 2014 researchers published a qualitative study on barriers and strategies related to fruit and vegetable purchases using a CVV. Focus groups were conducted at WIC clinics in Arizona with WIC participants. One positive theme from the groups was that participants reported that the CVVs were easier to use compared with other WIC benefits. Due to the fact that CVVs offer WIC recipients a wide selection of fruits and vegetables, participants noted that the CVVs were worth the effort to utilize each month even if that meant using multiple purchasing tools to complete transactions at the register. Another positive subtheme that arose from the focus groups in this study was the inclusion of both fresh and processed fruits and vegetables. Fresh produce was preferred, but participants also liked the convenience of having the option to include frozen and canned fruits and vegetables (Bertmann, Barroso, Ohri-Vachaspati, Hampl, Sell, & Wharton, 2014).

Even though participants complemented some of the aspects of the CVVs in regard to ease of usage and variety, participants also described some negative

experiences that limited their ability to fully redeem the CVV. One of these experiences was annoyance or anger from either the cashier or the other shoppers when redeeming their CVV. Other issues include complaints from participants in this focus group related to cashiers' lack of training and inconsistency of redemption rules at the stores. Participants from this research also reported feeling embarrassed when the CVV was identified (Bertmann, Barroso, Ohri-Vachaspati, Hampl, Sell, & Wharton, 2014).

More recently a systematic review of the revisions was published in the *Journal of the Academy of Nutrition and Dietetics* in August 2015. Only 20 articles were included in the meta-analysis that met all of the inclusion criteria. Nine of the articles analyzed change in dietary intake, eight examined changes in food availability, and three studies focused on breastfeeding exclusively (Schultz, Shanks, & Houghtaling, 2015).

Significant changes in fruits and vegetables consumption were noted among the articles from this review analyzing dietary intake. One article reports Hispanic mothers enrolled in WIC increased fruit consumption by 0.33 servings after the revisions were made to the program. Also, WIC-enrolled children consuming fruits and vegetables four or more times per day increased from 7.0% and 3.9%, respectively, to 11.5% and 8.0% after the revisions to the WIC food packages. Other studies included also support that fruit and vegetable intake increased among both child and caregivers enrolled in the WIC program. Among studies that included interviews, participants supported the revisions including the fruit and vegetable products (Schultz, Shanks, & Houghtaling, 2015).

Andreyeva & Tripp (2016) studied the overall healthfulness of food and beverage purchases after the package revisions of the WIC program. They were able to recruit a large sample examining point-of-sale data for 2137 WIC-participating households and 1303 comparison households. The researchers assessed the foods and beverages purchased based on saturated fat, sugar, and sodium content. The results of the study showed that healthy products accounted for most of the food volume purchased by WIC participants due to the subsidies for fruit, vegetables, and whole-grains in the revised WIC program. Beverage choices were healthier among WIC-participating households due to the reduced milk fat restrictions as well.

NHANES data were analyzed in an article published in the *American Academy of Pediatrics* assessing children's diet quality after the revisions to the WIC food package in article published in 2016. This study examined 1197 children aged two to four years from low income households participating in the WIC program. Data were analyzed from 2003-2008 prior to the policy revision and data from 2011-2012 after the policy revisions to the WIC food package. Researchers calculated the Healthy Eating Index-2010 (HEI-2010) using 24-hour diet recalls. Linear regression was used in this study to assess the difference in HEI-2010 and if was attributable to the food package changes. The average HEI-2010 scores for participants in the WIC program were 52.4 at baseline and 58.3 after the policy change. The average HEI-2010 scores for those that did not participate in the WIC program were 50.0 at baseline and 52.4 after the revisions. The revisions to the WIC food package indicate an adjusted average of 3.7

additional HEI-2010 points (95% confidence interval, 0.6-6.9) compared with those that did not participate in the WIC program. The results of this study indicate that the revised WIC packages were associated with a higher diet quality for children participating in the WIC program compared to children that were not participating in the WIC program (Tester, Leung, & Crawford, 2016).

Theoretical Focus

When researching dietary changes in behavior, the researcher must be mindful of theories that can offer insight on how people behave and in this study why some people are able to consume more fruits and vegetables. Bandura (1999) explains the basic tenants of social cognitive theory. Self-efficacy plays a pivotal role in the social cognitive theory. Unless someone believes that they can have a desired effect by their actions then they have little incentive to act. People may use other factors as motivators, but they are rooted in the core belief that one has the power to produce changes by one's actions. Perceived self-efficacy affects actions through its impact on other classes of determinants. Goal adoption enlists self-investment in the action. Once people commit themselves to goals, they seek satisfaction from fulfilling the goals. The motivational effects do not stem from the goals themselves, but from the self-evaluation that is made conditional upon fulfillment of the goals (Bandura, 1999).

The Fruit and Vegetable Inventory was used in this study (Townsend & Kaiser, 2006). Items on this instrument include the following constructs: perceived benefits, perceived control, self-efficacy, perceived barriers, social support, perceived norms, readiness to eat more fruit, readiness to eat more

vegetables, and perceived diet quality. Specifically, there are seven items on the original tool that measure self-efficacy. Self-efficacy in this study can be defined as a person's confidence that he or she can choose to eat fruits or vegetables in different situations or circumstances (Townsend & Kaiser, 2005).

The Stages of Change Model or Transtheoretical Model has become one of the most influential theoretical models in the health psychology area. This model includes the following dimensions: the stages of change, the dependent variable dimension, and the independent variable dimension. The stage of change is the temporal dimension of readiness to change a behavior. The following are the stages: precontemplation, contemplation, preparation, action, and maintenance. Stage specifically defines when change occurs in a person and can assist in interventions to show participants where they are in the change process. The stages are dynamic variables and people are expected to move from one stage to another (Greene, Rossi, Rossi, Velicer, Fava, & Prochaska, 1999).

The dependent variable dimension includes behavior, decisional variance, and self-efficacy or temptation. The decisional balance measures the relative importance to the individual of the advantages and disadvantages. Self-efficacy is a concept that was included in Bandura's social cognitive theory. Self-efficacy represents the situation-specific confidence people have that they can engage in a desired behavior change. The opposite of this concept is called situation-specific temptation (Greene et al., 1999).

The independent variable dimension or process of change is one of the least studied concepts in the Stages of Change Model. Processes are the covert and overt actions that people use to move through the stages and how people change. Processes that involve thoughts, feelings, and experience are known as experiential processes and those that focus on behaviors and reinforcement are behavioral processes. When applying The Transtheoretical Model to dietary interventions, desired effects can be increased if researchers match the dietary feedback, the processes, and the decisional balance and temptation of change with the specific stage of change (Greene et al., 1999).

Readiness for change is the temporal dimension of Prochaska's Transtheoretical Model of Behavior Change and is grouped into two different constructs in this study – readiness to eat more fruit and readiness to eat more vegetables. Eating more fruit and vegetables is considered increasing current intakes of fruits and vegetables as compared to the amount eaten in the past (Townsend & Kaiser, 2007).

Many Americans do not follow the dietary recommendations to consume adequate fruits and vegetables (Guenther et al., 2006; Thompson, Midthune, Subar, McNeel, Berrigan, & Kipnis, 2005). WIC provides supplemental nutrition to children and women (U.S. Department of Agriculture, Food and Nutrition Service, 2013a). The current food package includes a CVV for fruits and vegetables for fresh, canned, or frozen fruits and vegetables. Research on WIC participants has traditionally used the older food package and focused on impact of the program enhancements (Whaley et al., 2012). In contrast and in an effort

to gather data and increase feedback, this study will use the revised food package and will focus on the effect of providing CVVs specifically for fruits and vegetables on WIC participants' behaviors about fruits and vegetables in Tennessee.

CHAPTER THREE: METHODS

Despite recommendations from the government and nutrition professionals, most Americans do not consume the recommended servings of fruits and vegetables per day (Guenther et al., 2006; Thompson, Midthune, Subar, McNeel, Berrigan, & Kipnis, 2005). Low-income populations are even less likely to consume fruits and vegetables (Anderson, Bybee, Brown, McLean, Garcia, Breer, & Schillo, 2001; Cassasy, Jetter, & Culp, 2007; Kropf, Holben, Holcomb, & Anderson, 2007). The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) offers a cash value voucher (CVV) that can only be redeemed for fresh, frozen, or canned fruits and vegetables to participants in the WIC program as part of the revised food package (Whaley et al., 2012). This study focuses specifically on the CVVs and examines attitudes and behaviors about fruits and vegetables before and after having access to these vouchers that can be redeemed for fruits and vegetables. It was conducted at local health departments in Tennessee and data collection coincides with their initial WIC visit for certification and follow-up appointment to continue to receive WIC services.

Purpose

The purpose of this study is to examine the effect of providing CVVs for fruits and vegetables on WIC participants' consumption of fruits and vegetables in Tennessee.

Hypotheses

The following hypothesis was tested: WIC participants who receive a CVV for fruits and vegetables will consume more fruits and vegetables after having access to CVV for fruits and vegetables. The researcher controlled for race, age, number of children, number of adults, perceived benefit, perceived control, and self-efficacy.

Study Design and Participants

The Principal Investigator (PI) of this study was a Public Health County Director for Dickson and Humphreys Counties in Tennessee in 2014 when this research was initially proposed. The patients from the local health departments in these counties were the initial target population, but the target counties were later modified to increase the number of participants. The PI received Institutional Review Board (IRB) approval from both Middle Tennessee State University and the Tennessee Department of Health to conduct this study.

Inclusion criteria for the individuals in the study included the following:

1. Those certified for WIC participation as a prenatal mother;
2. No other members of the household currently receiving WIC services;
3. Receivers of WIC services at the participating local health department during the specified months;
4. Speakers of English;
5. Those 18 years of age or older.

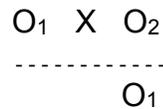
The goal of this study is to only include WIC participants that are not currently receiving the vouchers for fruits and vegetables in the household, so the

effect of these vouchers can be assessed. The experimental group received both a pretest and posttest. Pregnant mothers received the pretest at their initial certification appointment at the health department when they received the vouchers initially and this group received the posttest when they returned for additional vouchers three months later. Since this is a federal program, participation in the WIC program could not be limited and access to CVVs could not be denied to anyone who qualifies, thus a modified control group was used in this study. The waitlist control group consisted of a group of new mothers that received the pretest during the same month as the experimental group received their posttest.

The experimental group received a pretest and posttest with the goal of detecting the change among attitudes and behaviors among WIC participants after receiving WIC vouchers for fruits and vegetables. All individuals that met the inclusion criteria were asked to participate in the study. If they consented, a pretest was administered to these women during their initial visit to the health department. In order to continue receiving food packages, WIC participants must come back every three months. When they came back for vouchers, the posttest was administered at that time. The posttest was given to the experimental group after they have had three months of vouchers for fruits and vegetables.

A modified nonequivalent control group was used to help measure the effectiveness of the vouchers. All WIC participants received the vouchers for fruits and vegetables, so a true control group was not feasible by denying women who qualify for the federally funded supplemental food program. The pretest was

administered to a new group of WIC participants that served as the control group at the same time the experimental group received their posttest. Figure 1 represents a three month period, so the pretest for the control group was given during the same month that the experimental group received the posttest. Both the experimental and control groups had not had access to the vouchers for fruits and vegetables when the pretest was administered.



Key:

X = Treatment

O₁ = Pretest

O₂ = Posttest

Figure 1. Modified nonequivalent control group design

This figure shows one group that received a pretest and posttest which was used for the experimental group and the modified nonequivalent control group. The prenatal mothers enrolled in the WIC program completed the pretest during their initial certification appointment. The treatment was the vouchers for fresh fruits and vegetables. The posttest was administered after the mother has had three months to use the vouchers and returned for a follow-up appointment, which is required to stay enrolled in the program. The control group consisted of prenatal mothers enrolled in the WIC program that completed the pretest during at their initial certification appointment during the same month that the posttest is given to the experimental group.

Threats to Validity

Internal validity in this study can be considered the extent to which the vouchers for fruits and vegetables change the participants' attitudes and behaviors regarding fruits and vegetables. There were several threats to internal validity in this study design that should be noted. Testing, or carry-over effect, was a threat to internal validity because administering a pretest changes posttest results. Instrumentation was a threat to internal validity because even though the instrument has been developed and tested in similar low-income populations, the reliability of the instruments has not been tested in a multitude of studies. Another threat to internal validity was experimental mortality, where the participants drop out of the study. Patients at the health department often fail to keep follow-up appointments as scheduled. However, the WIC patients are required to come to the health department to continue receiving vouchers, helping to minimize this threat. Expectancy, which is when the researcher expects that certain participants will perform better was a threat to validity. In this study, the experimental group that received the vouchers were expected to consume more fruits and vegetables as opposed to the control group. Selection bias was also a threat to internal validity since groups were not randomized. Selection bias was reduced in this study because it is expected that both the control and experimental groups will be similarly matched on variables as they were all selected from the same population. Both groups were expected to have to similar demographics including age, income, education, race, and pregnancy status.

External validity relates to how this study could be applied in real world situations. External validity can be threatened by reactive or interactive effects of testing. For example, participants in the experimental group may have responded differently because of the pretest. Also, there was a threat of multiple-treatment interference which occurs when the same participants receive more than one treatment in succession. If a participant was enrolled in a weight loss program and trying to lose weight, they might be more inclined to purchase fresh fruits and vegetables regardless if they had they had the voucher or not, so the treatment would not be beneficial to them.

Instruments

The Fruit and Vegetable Inventory was one of the two surveys used in this study (Townsend & Kaiser, 2006). This survey is an evaluation tool developed by the University of California Cooperative Extension specifically for nutrition education programs serving low-income communities. This instrument is intended to be used prior to the first nutrition lesson taught to participants and then after the last nutrition lesson is taught (Townsend, Leaven, Davidson, & Kaiser, 2006). Items on this tool can be grouped into nine constructs: perceived benefits, perceived control, self-efficacy, perceived barriers, social support, perceived norms, readiness to eat more fruit, readiness to eat more vegetables, and perceived diet quality (Townsend & Kaiser, 2005).

During the development process of this survey researchers assessed psychosocial constructs of the Fruit and Vegetable Inventory. The goal was to develop a tool for use in the community and criteria were established to delete

items that did not contribute to the instrument or that detracted from the instrument. Temporal reliability was tested by having participants complete the survey twice over a period of time with no intervention. Internal consistency was also assessed using Cronbach's alpha. Inter-item correlations were calculated to examine the extent of the relationship between each item and the rest of the items within the item's construct. Analysis of variance (ANOVA) was used to ensure that different ethnic groups responded similarly to the items (Townsend & Kaiser, 2005).

This inventory includes several statements and the participant must select one of the following three choices: agree, agree or disagree, or disagree.

Statements that are grouped in the construct of self-efficacy include the following:

I feel that I can buy more fruit the next time I shop.

I feel that I can plan meals or snacks with more fruit during the next week.

I feel that I can buy more vegetables the next time I shop.

I feel that I can plan meals with more vegetables during the next week.

I feel that I can eat fruits or vegetables as snacks.

I feel that I can add extra vegetables to casseroles and stews.

I feel that I can eat 2 or more servings of vegetables at dinner.

Interestingly, the item *I feel that I can buy more fruit the next time I shop* did not contribute to the construct. Cronbach's alpha was .77 with all seven items and when this item was removed and the Cronbach's alpha was practically unchanged at .76 with six items (Townsend & Kaiser, 2005). These questions for

self-efficacy will be given to the participants in this study on The Fruit and Vegetable Inventory and survey results will be evaluated and analyzed.

Readiness for change is measured by five items for fruits and five items for vegetables. Participants are asked to choose the one statement that fits their preference. The statements for fruit include the following:

I am not thinking about eating more fruit.

I am thinking about eating more fruit...planning to start within 6 months.

I am definitely planning to eat more fruit in the next month.

I am trying to eat more fruit now.

I am already eating 3 or more servings of fruit a day.

The statements for vegetables include the following:

I am not thinking about eating more vegetables.

I am thinking about eating more vegetables...planning to start within 6 months.

I am definitely planning to eat more vegetables in the next month.

I am trying to eat more vegetables now.

I am already eating 3 or more servings of vegetables a day.

Participants will be grouped into one of five categories based on their responses and this will be their state of change (Townsend & Kaiser, 2005). Both readiness to eat more fruit and readiness to eat more vegetables constructs will be assessed during the study with these questions. Townsend & Kaiser (2005) used the test-retest method to determine reliability. The statements that are grouped into the construct of readiness to eat more fruit have a correlation of .62

and the construct of readiness to eat more vegetables had a test-retest correlation of .59.

Like reliability, validity is another essential psychometric property of a well-constructed tool. Townsend & Kaiser (2005) assessed the validity of the Fruit and Vegetable Inventory using several different approaches for this assessment using Spearman rank order correlations. The following were tested for validity purposes: a composite score with a biochemical marker of fruit and vegetable intake (serum carotenoids), hypothesized nutrients from the mean of the 24-hour recall, servings of fruits and vegetables from the recalls, the Healthy Eating Index, and a fruit and vegetable scale. The biochemical marker of fruit and vegetable intake of serum carotenoids was selected because of their presence in fruits and vegetables. Three 24-hour dietary recalls were collected from all of the participants and detailed descriptions of all foods and beverages the subjects consumed were collected as well. Constructs on the tool were determined valid if there were statistically significant relationships between that specific construct and 1 or more of the 5 indicators of diet quality.

The final version of the Fruit and Vegetable Inventory showed significant correlations with indicators of diet quality: serum carotenoid ($r = .38$), hypothesized nutrients calculated from the mean of three 24-hour dietary recalls (vitamin C, $r = .37$; vitamin A, $r = .39$; folate, $r = .37$; beta carotene, $r = .31$; and fiber, $r = .46$), fruit and vegetable servings ($r = .55$), Healthy Eating Index ($r = .27$), and fruit and vegetable behavioral scale ($r = .60$) (Townsend & Kaiser, 2005).

In addition to the Fruit and Vegetable Inventory, the Fruit and Vegetable Checklist was also used in this study (Sylva, Townsend, Martin, & Metz, 2006). This checklist is specifically designed for fruit and vegetable behavior. The behavior scale (or fruit and vegetable checklist) measures consumption of fruits and vegetables, and the psychosocial (or fruit and vegetable inventory) measures attitudes. Both have been used for pre and posttests as a small section or subset of questions from a brief, but more complete food behavior checklist. Researchers limited the questionnaire based on feedback from county nutritionists during the development process of this tool. Reliability was assessed by having participants complete the checklist on two occasions three weeks apart with no intervention.

The Spearman rank order correlation between the scores for each item at the different test times was used to examine the reliability or stability of the items. Reliability coefficients showed that 20 of the 22 items met the criterion and all of the items that were kept for the checklist had an acceptable level of stability ($p < .05$). The Cronbach's alpha to measure internal consistency for the fruit and vegetable subscale has an acceptable value of .80 (Townsend, Kaiser, Allen, Joy, & Murphy, 2003).

Other properties such as validity and readability were also assessed during the development of the food behavior questionnaire. Criterion validity of the fruit and vegetable section of the checklist was examined using serum carotenoids, which showed a significant correlation ($r = .44$) indicating validity. The readability for the checklist was less than a fourth-grade level based on the

Flesch Kincaid score of 2.8, which indicates a reading level of third grade and the Flesch Reading Ease score of 96, which is considered to be very easy reading. The researchers desired a readability of below the sixth-grade level for this checklist due to the limited literacy among the target population (Townsend et al., 2003).

Target Population

The target population for this study was low-income pregnant women that were eligible for the WIC program. The women were enrollees of the WIC program administered at the following local health departments in Tennessee: Lawrence County, Greene County, and Blount County. Lawrence County is the smallest county participating in this study with a total population of 41,990 in 2015. The population in Lawrence County is 94.4% non-Hispanic white and 51.1% females. Food insecurity affects 16% of population in Lawrence County and 3% have limited access to healthy foods (County Health Rankings, 2015).

Greene County is the next largest county with a population of 68,267. Greene County is 93.4% Non-Hispanic white and 50.9% females. Seventeen percent of the population in Greene County is affected by food insecurity and 4% of the population has limited access to healthy foods (County Health Rankings, 2015).

The largest county participating in this study is Blount County with a population of 125,099 people. The demographics of Blount County is 91.6% Non-Hispanic white and 51.5% female. Food insecurity affects 13% of the

population in Blount County and 10% have limited access to healthy foods (County Health Rankings, 2015).

Procedures

This study was conducted at the following local health departments in Tennessee: Lawrence County, Greene County, and Blount County. The target population was prenatal WIC participants. The goal was to recruit pregnant mothers at their initial WIC certification for the initial pretest. Under the WIC program, multiple people in a household may receive WIC benefits, for example the mother and several children may be concurrently enrolled. The mothers included in this study could not have anyone else in the household currently enrolled in the WIC program. The mother could have previously been enrolled with prior children as long as they were not enrolled at the time of the study. These mothers do not have access to the vouchers for fruits and vegetables at the time of enrollment, so the effect of these vouchers on their attitude and behavior can be assessed throughout the study.

When a participant arrives at the local health department, they are required to check in with the clerical staff. It is at this time the mother informs the staff that she is pregnant and would like to receive WIC services. In order to be certified for the WIC program, the pregnant mother must bring ID, proof of income, a piece of mail confirming address, and confirmation of pregnancy. The clerical staff gives the mother a nutrition questionnaire and a medical history form to complete. For data collection purposes for this study, the following additional forms were provided to the participant at registration: the consent form, a

demographic form, Fruit and Vegetable Checklist, and Fruit and Vegetable Inventory. Once a participant completed these forms, the forms were collected by the health department staff and the project specific forms were returned to the PI.

After a patient is certified, she receives a WIC food package specific for her needs as a prenatal woman. She is seen by both a Registered Nurse and the Nutritionist/Nutrition Educator at her initial visit. If the Nutritionist/Nutrition Educator is not available, the Registered Nurse may go over the nutrition information and food package with the client. The clerical staff prints three months of food vouchers and issues the vouchers to the woman.

After the vouchers have been used, the women must return for more vouchers. For example, if a woman's initial visit was February 2, 2014, she received vouchers for February, March, and April. At this initial visit she completes the baseline questionnaire and survey, which will consist of the consent, Fruit and Vegetable Checklist, Fruit and Vegetable Inventory, and a demographic questionnaire. She will need to return in three months, in this example at the end of April or beginning of May in order to receive more vouchers for the months of May, June, and July. When she returns, she will also take the posttest. The posttest will be the same with the exception of the consent form and demographic questionnaire. Because this is a modified nonequivalent control group design, the new prenatal mothers in the waitlist control group who are first appearing for their initial certification in May will get the pretest at the same time as the experimental group is receiving their posttest. It can be

expected that the prenatal mothers in the control group taking the pretest in May will have similar results as those in the experimental group taking the pretest in March since neither group has had access to the fruit and vegetable vouchers.

The PI worked directly with the Public Health Country Directors at each of the three clinics that were participating in this research. The PI mailed all of the documents to each health department and provided certified envelopes to return completed forms during the data collection periods. The directors provided the clerical staff with the documents for the participants. The clerical staff administered the documents to the participants and the directors were responsible for ensuring the completed forms were returned timely.

This study examined the effect of providing vouchers for fruits and vegetables on WIC participants' behaviors about fruits and vegetables by using two instruments for pre and posttests. The hypothesis is that the WIC participants who received a voucher for fruits and vegetables consumed more fruits and vegetables than WIC participants who do not receive a cash value voucher. An experimental group of prenatal mothers were given a pretest at their initial certification appointment. To continue receiving vouchers, WIC participants are required to return in three months following their first appointment, which is when the posttest was given to the experimental group. A modified nonequivalent control group was used to measure the effectiveness of the vouchers by administering the pretest to a new group of WIC participants at the same time the experimental group receives their posttest. During the same month of the posttest for the experimental group, another group of women were

receiving their initial certification, which was considered the pretest for the control group. The Fruit and Vegetable Inventory (Townsend & Kaiser, 2006) and the Fruit and Vegetable Checklist (Sylva, Townsend, Martin, & Metz, 2006) were both used together as the pre and posttests in this study. This study examined the effectiveness of the revised WIC food package, specifically the cash value vouchers (CVVs), on attitudes and behaviors regarding fruits and vegetables among WIC participants.

Analysis is performed with SPSS for Windows Version 22.0. Descriptive statistics were calculated, and analysis of covariance (ANCOVA) was used to analyze the data from this study. Fruit and vegetable intake at baseline is compared with fruit and vegetable intake three months after initially receiving the vouchers in the experimental group. Attitudes regarding fruits and vegetables were also assessed initially and compared with the attitudes three months after participants receive the vouchers.

When assessing self-efficacy, there is one question (Q3) that concerns both fruits and vegetables combined, one question (Q5) for fruits only, and four questions (Q4, Q6, Q7, Q8) for vegetables only. These six questions are combined into a single index for self-efficacy of both fruits and vegetables. Readiness to eat more fruit and readiness to eat more vegetables are two separate questions, so they remain two different scores to see if there is any difference between fruits and vegetables for this measure. Consumption of fruits and vegetables consists of five items on the fruit and vegetable checklist (Q1, Q2, Q4, Q5, and Q7). The following questions are used and indexes are

computed by combining questions for 1, 2, 3, 7, and 8 on both survey instruments:

1. Perceived Benefit (Index combining 2 items: Q1 & Q2)
2. Perceived Control (Index combining 2 items: Q10 & Q11)
3. Self-Efficacy (Index combining 6 items: Q3-Q8)
4. Readiness to eat more fruit (Q12)
5. Readiness to eat more vegetables (Q13)
6. Perceived diet quality (Q9)
7. Fruit and Vegetable Consumption (Index combining Q1, Q2, Q4, Q5, and Q7 on Fruit and Vegetable Checklist)
8. Fruit and Vegetable Amount (Index combining Q3 and Q6 on Fruit and Vegetable Checklist)

There are three sets of measures available from the data collected on the survey instruments: (1) pretest for the experimental group, (2) posttest for the experimental group and (3) pretest for the control group.

ANOVA is used to determine if there are any differences between conditions in (1) and (3) regarding the survey results. This analysis examines whether the experimental group and control group had similar pretest scores on the measures and checks for selection bias. This tests whether the experimental group and control group were different on any of the measures initially.

Repeated measures ANOVA is used to compare the mean scores from (1) and (2) to determine if experimental group changed on any measures after receiving vouchers.

The main purpose of this study is to examine the effect of providing cash value vouchers (CVVs) for fruits and vegetables on WIC participants' behaviors regarding fruits and vegetables. Using the statistical analysis procedures outlined, the following hypothesis is tested: WIC participants who receive a CVV for fruits and vegetables will consume more fruits and vegetables than WIC participants who do not receive a CVV for fruits and vegetables.

CHAPTER FOUR:

RESULTS

The purpose of this investigation was to examine the effect of providing cash value vouchers (CVVs) for fruits and vegetables on WIC participants' behaviors regarding fruits and vegetables at three local health departments across Tennessee. The following hypothesis is tested in this study: WIC participants who receive a CVV for fruits and vegetables will consume more fruits and vegetables after having access to CVV for fruits and vegetables. The researcher controlled for race, age, number of children, number of adults, perceived benefit, perceived control, and self-efficacy.

Selection of Participants

Ten counties in Tennessee were asked to participate in this research. The Public Health County Director needed to be supportive of this research since it could potentially slow down the efficiency of the WIC clinic. The PI sent invitations to participate in the study via email to the Public Health County Director's at the local health departments. It was very important for the counties to have experienced personnel in their clerical and nutrition positions since this study required additional paperwork, so many were not interested in participating due to staffing issues or lack of support from Regional Administration. Five of the ten counties responded to the PI and reported being willing to participate in the research.

After learning that Rutherford County also participated in the WIC Farmers' Market Nutrition Program (FMNP), which provides additional vouchers for fresh fruits and vegetables to WIC participants at farmers' markets, it was decided that Rutherford County should not participate in this research since this study aimed to examine the fruit and vegetable consumption specifically from the CVVs from the WIC program. The WIC FMNP in Tennessee is only available to very small number of health departments and funding for these vouchers are in addition to the standard WIC packages.

Monroe County was very interested in participating in the study initially; however, the surveys were not completed correctly or timely. After questioning the Public Health County Director regarding the delay in completed surveys, the PI learned of a death in the family for a key staff member and this county was no longer able to participate. Thus, the following health departments in three counties participated in the study: Lawrence County, Greene County, and Blount County.

Participants were selected if they consented to the research while being initially certified to receive WIC services at the participating health department during the selected months. These mothers were English speaking, at least 18 years of age or older, and had no other members of the household receiving WIC services.

WIC participants ($N = 93$) were recruited as volunteer participants for the experimental and waitlist control groups. Participants were placed into two groups depending on the month of initial certification: experimental group ($n = 56$)

and wait-list control ($n = 37$). A modified nonequivalent control group design was used in this study to help measure the effectiveness of the CVVs because withholding access to the WIC program to participants in order to have a true control group was not possible. The experimental group completed the pretest prior to having the CVVs and this group also completed a posttest three months after receiving the CVVs. The wait-list control group ($n = 37$) completed a pretest at same time the experimental group received their posttest. The pretest for the wait-list control was the same as the pretest and posttest for the experimental group.

Attrition of Participants

There were 56 eligible participants that completed the pretest in the experimental group and 34 participants (60.72%) completed the posttest. The researcher made efforts to contact participants to schedule an appointment at the local health department to complete the posttest and to continue receiving WIC services.

Description of the Participants

The sample size was 93 participants total, all of which were women receiving WIC services at local health departments. Overall, the mean age for participants was 23.29 years of age ($SD = 5.06$) and the average number of children for the entire sample was .79 ($SD = 1.10$) or about 1 child. The mean monthly food cost was \$332.23 ($SD = 171.07$) and the mean monthly income was \$1148.15 ($SD = 853.37$). Participants that completed high school comprised

49.4% ($n = 45$) of the sample and 91.3% ($n = 85$) of the total sample for this study identified themselves as White.

The sample size of the experimental group was 56 participants with a mean age of 22.60 years ($SD = 4.95$) as shown in Table 1. The average number of children per participant was .64 ($SD = 1.06$) which is approximately 1 child. The mean monthly food cost was \$316.27 ($SD = 148.11$) and the mean monthly income was \$1090.07 ($SD = 907.92$) for this group. Among the participants 10.7% ($n = 6$) did not complete high school, 50.90% ($n = 28$) obtained their high school diploma or GED, 35.70% ($n = 20$) have completed some college or technical school, and 2.7% ($n = 1$) reported having a Bachelor's degree. Ninety one percent ($n = 51$) of the participants reported White for race, while 1.8% ($n = 1$) reported their race as Black, 3.6% ($n = 2$) reported Asian, and 3.6% ($n = 2$) reported Native American.

The sample size for the wait-list control group was 37 participants with a mean age of 24.50 years ($SD = 5.10$) as shown in Table 1. The mean number of children for this group is 1.03 ($SD = 1.13$) which is slightly more than 1 child. The mean monthly food cost was \$362.31 ($SD = 207.52$) and the mean monthly income was \$1253.93 ($SD = 747.86$). Participants reported that 10.8% ($n = 4$) did not complete high school, 46% ($n = 17$) obtained their high school diploma or GED, 40.50% ($n = 15$) attended some college or technical school, and 2.7% ($n = 1$) received their Bachelor's degree. Participants 91.9% ($n = 34$) reported their race as White and 8.1% ($n = 3$) reported Black for their race. Among all participants, the mean perceived benefit equals .76 ($SD = .29$). The mean

perceived control equals 2.38 ($SD = .60$) for both groups. The mean for self-efficacy is 2.81 ($SD = .32$). The mean fruit and vegetable consumption is 2.24 ($SD = .51$) and the mean fruit and vegetable amount is 2.20 ($SD = .96$).

Development of the Indexes

Indexes were developed from the two survey instruments used in this study. One of the instruments used was the Fruit and Vegetable Inventory (Townsend & Kaiser, 2006) evaluation tool consisting of 13 items specifically developed to assess attitudes towards fruits and vegetables. The first two questions on this survey are combined into an index called perceived benefit (PB) because these questions are asking about the benefits of fruits and vegetables and health problems associated with lack of fruits and vegetables in the diet. Items Q3-Q8 on this inventory pertain to the ability to include more fruits and vegetable when shopping and planning meals and snacks, so these are grouped together to form the self-efficacy index (SE). Responses for both the perceived benefit index and the self-efficacy index are as follows: “agree”, “agree or disagree”, and “disagree”. Another index developed from this inventory is called perceived control, which combines Q10 and Q11 regarding purchasing and preparation of food in the household. The response choices are “I am”, “shared decision,” and “other person.” This index required a reverse recoding thus the variable name PCREV.

Three questions from this inventory are assessed individually. Question 9 asks the participant to describe their diet, so this question is considered perceived diet quality. The survey gives five options ranging from “excellent” to

“poor.” Readiness to eat more fruit (Q12) and Readiness to eat more vegetables (Q13) are kept separate to assess if there is a difference between fruits and vegetables among participants. The five responses available for selection for the questions “Readiness to eat more fruit” and “Readiness to eat more vegetables” range from “I am already eating 3 or more servings of fruit a day” to “I am not thinking about eating more fruit.”

The Fruit and Vegetable Checklist was also used in this study (Sylva, Townsend, Martin, & Metz, 2006), which is designed to measure behavior in regards to fruit and vegetable consumption. Four (Q1, Q4, Q5, and Q7) of the seven items on this checklist have responses ranging from “yes, always” to “no” when asking participants to select how often they eat fruits and vegetables as snacks, more than one kind of fruit each day, more than one kind of vegetable each day, and 2 or more vegetables at the main meal. When entering the responses into SPSS, “yes, everyday” was coded as 4, “yes, often” was coded as 3, “yes, sometimes” was coded 2, and “no” was coded as 0. Another question (Q2) also asked specifically about citrus fruit or citrus juice during the past week and the only responses available to select were “yes” and “no.” This measure was important to be included in the index measuring total fruit and vegetable consumption and responses were coded as 2.5 for “yes” and 0 for “no” when entering data into SPSS. The fruit and vegetable consumption (FVC) index consisted of five questions from the fruit and vegetable checklist (Q1, Q2, Q4, Q5, and Q7).

The other index constructed from this evaluation tool was fruit and vegetable amount (FVA) because these two questions (Q3 and Q6) asked participants the number of cups of fruits and vegetables they consumed daily. The responses available were “none” to “3 of more cups.” Responses were entered into SPSS based on actual number of cups eaten per day. For example, if the participant selected 1½ cups then 1.5 was entered.

The means for each of the indexes are shown in Table 2 for the pretest experimental group, the pretest control group, and the posttest experimental group. The mean fruit and vegetable consumption is 2.24 ($SD = .48$) for the pretest and 2.48 ($SD = .61$) for the posttest in the experimental group. The mean fruit and vegetable consumption is 2.23 ($SD = .55$) for the pretest in the control group.

Data Analysis

Equivalency of groups was tested first by doing a one-way independent ANOVA on the pre-test scores for experimental and control groups while controlling for race, age, number of children, number of adults, income, cost of food, perceived benefit, perceived control, and self-efficacy as covariates. Table 3 shows the pretest fruit and vegetable scores for the experimental and control groups. Since the p-value is .893, this indicates that the two groups were not significantly different on the pretest. Table 4 shows the results from one-way ANOVAs comparing potential continuous covariates and none are significant. Table 5 shows the results of the chi-square tests comparing categorical covariates. The covariate of having a child is significant with a p-value of .02.

Descriptive statistics for the experimental group in repeated measures ANOVA tests are shown in Table 6 with and without children since this variable is the only significant covariate in the chi-square test. The pretest score for fruit and vegetable consumption for subjects with children is 2.33 ($SD=.42$) and 2.37 ($SD=.43$) for participants without children. The posttest score is 2.54 ($SD=.63$) for participants with children and 2.37 ($SD=.52$) for those without children. Both Kolmogorov-Smirnov and Shapiro-Wilk are used to test the assumption of normality and both indicate a normal distribution among the experimental group from pretest to posttest regarding fruit and vegetable consumption. Table 7 shows the p -value for the fruit and vegetable consumption pretest is .200 and the p -value is .052 for the fruit and vegetable consumption posttest with the Kolmogorov-Smirnov test. The Shapiro-Wilk test reveals a p -value of .427 fruit and vegetable consumption pretest and a p -value of .271 for the fruit and vegetable consumption posttest. Box's test is also used to test the assumption of homogeneity of covariance matrices and it is non-significant $F(3, 8215.5) = 0.355, p = .79$.

Repeated measures ANOVA is used to compare pretest and posttest scores on fruit and vegetable consumption while controlling for race, age, number of children, number of adults, perceived benefit, perceived control, and self-efficacy on the experimental group. The p -value is .435 when examining the change between the pretest score for fruit and vegetable consumption in the experimental group and this is shown in Table 8. Since the only covariate that was significant was having children, it is also included and the p -value with that

covariate is .435, which indicates no interaction between having a child and change in fruit and vegetable consumption from pretest to posttest. Table 9 shows that having a child does not have an effect on posttest scores with a p -value of .647.

Summary of Results

The primary purpose of this investigation was to determine if providing cash value vouchers (CVVs) for fruits and vegetables would increase fruit and vegetable consumption among WIC participants. Equivalency of groups was tested first by doing a one-way ANOVA on the pre-test scores while controlling for race, age, number of children, number of adults, income, cost of food, perceived benefit, perceived control, and self-efficacy. The results of the ANOVA are shown in Table 3 and the experimental and control groups are considered equivalent.

In order to see if there was a different between pretest and posttest values for fruit and vegetable consumption in the experimental group repeated measures ANOVA was used while controlling for race, age, number of children, number of adults, perceived benefit, perceived control, and self-efficacy. The mean score for fruit and vegetable consumption did increase as shown in Table 2; however, it was not a significant increase and it cannot be attributed to access to the vouchers. The mean scores for the additional indexes (perceived benefit, perceived control, self-efficacy, and fruit and vegetable amount) also increased from pretest to posttest in the experimental group, but these were not statistically significant increases.

The results of this study indicate that offering CVVs to women participating in the WIC program does not significantly increase their fruit and vegetable consumption.

CHAPTER FIVE: DISCUSSION

There were 93 total women that participated in this research at local health departments in Tennessee. There were 56 eligible participants that completed the pretest for the experimental group and 34 of those participants completed the posttest. The wait-list control group consisted of 37 women that received the pretest at the same time the experimental group received the posttest. These women all qualified to participate in the WIC program.

Fruit and Vegetable Attitudes and Behaviors

Attitudes regarding fruits and vegetables were assessed using questions from the fruit and vegetable inventory. The following indexes were developed regarding attitudes of fruits and vegetables: perceived benefit, perceived control, and self-efficacy.

The primary purpose of this investigation was to determine if providing cash value vouchers (CVVs) for fruits and vegetables would increase fruit and vegetable consumption among WIC participants. It was hypothesized that WIC participants that received a CVV for fruits and vegetables consumed more fruits and vegetables than WIC participants who do not receive a CVV for fruits and vegetables when controlling for race, age, number of children, number of adults, perceived benefit, perceived control, and self-efficacy. The analysis revealed that fruit and vegetable consumption did increase in the experimental group from

pre to posttest; however, it cannot be attributed the effect of the CVVs and it was not a statically significant increase.

Outcomes

Even though the hypothesis was rejected and the CVVs did not statistically increase fruit and vegetable consumption among WIC participants in this study, the results indicate that consumption did increase and can allow more effective research on WIC in the future.

Limitations

This research had many limitations that should be noted. This study only included WIC participants in three counties in Tennessee. It was difficult recruiting health departments initially to participate in this research due to a variety of reasons such as inexperienced clerical and nutrition staff and fear of increasing patient wait times in the clinic. Ten counties were asked to participate with the hopes of obtaining a large sample size, but only three counties were willing and able to participate for the duration of the study.

The inclusion criteria included only English speaking women due to the lack of translators available at all clinics. Language lines and other resources are available for staff to use to assist non-English speaking patients, but this process can be burdensome and the PI wanted the additional survey forms to be implemented without interrupting the efficiency of the WIC clinic at the local health departments. The diversity of the demographics was limited as 91.3% women in the population studied were White.

Since the CVVs were already implemented to the revised WIC food package, this study only involved prenatal mothers who were initially applying to participate in the WIC program. If other members of the household were receiving WIC services they were not able to participate, which also decreased the number of eligible participants. Specifically, if the mother had other children in the household covered by WIC, she was excluded from the study. This effectively limited the study population to first time mothers and those mothers with previous children over five years old.

Also, a true control group was not available due to all eligible WIC participants receiving vouchers for fruits and vegetables with the revised food package. Thus, a nonequivalent control group design was used. A wait-list control group was used that met the same criteria as the experimental group.

Another concern that should be noted is that paper survey instruments were used in this study. These forms were specifically designed for low-income population and to assess the attitudes and behaviors regarding fruits and vegetables. The Tennessee Department of Health is not using electronic health records at this time, so many services available at the health department use an abundance of paper, including WIC certification and building paper charts for the WIC mother and children. The paper surveys were given to participants when all of the other required paperwork was given to them initially to apply for WIC. The paper copies of the surveys were again distributed to the experimental group for the posttest.

Another potential limitation with this investigation is the relatively short duration of the study. Three months may have been too short of a time period for participants to learn about the benefits of fruits and vegetables through the WIC nutrition education services and implement this knowledge to change their behavior to incorporate more fruits and vegetables into their diet.

Even though there were several limitations in this study, there were several positive aspects that should be noted. One positive element of this research was the use of a validated and reliable instrument. The fruit and vegetable inventory and the fruit and vegetable checklist were both developed by the University of California Cooperative Extension specifically for nutrition education programs serving low-income communities, which is ideal for the WIC population.

Another positive aspect about this study was the participant tracking system used at the health departments for participants in this study. Identification numbers were assigned to each participant for confidentiality. This number was a key for the PI to interpret the county, group, and pretest or posttest phase of the participant. This number was written by the PI on both forms. Once the participant from the experimental completed their pretest, the posttest with the corresponding ID for that participant was placed in their medical record. At their next visit to receive more vouchers, any staff member that had access to that chart could easily see that that particular participant was enrolled in the study and needed to complete the posttest.

Future Recommendations

This study is part of a small number of studies that have been conducted specifically on fruit and vegetable consumption among WIC participants using CVVs. If this research were to be conducted again, there are several changes that could potentially improve the data collection and results. If the research area could be expanded and include more counties in Tennessee or other states, the sample size would increase significantly. It would be beneficial to have a more diverse population instead of having all English speaking women and over 90% of the population White.

If the surveys could have been web-based or if a mobile app was available, then we could have potentially had more than 60.72% of the experimental group complete the posttest. Due to the limited funding and lack of electronic medical records, paper surveys were required for this investigation. In the future it would be helpful to have access to data from an app or online survey tool, so that the researchers would not have to require the participant come into the health department in order to complete the paper survey for the pretest or posttest. Also, if participants could enter data without being at the health department then data collection could occur anytime while the mother is receiving WIC services. This would reduce the work burden on health department staff and potentially further increase the number of participating counties and therefore increase the sample size and completion rate. It would be possible to track a mother and her behaviors and attitudes regarding fruits and

vegetables from the time she gets certified as a prenatal mother until her child is five years of age if she participates in the program for that amount of time.

Since Tennessee provides paper WIC checks and paper CVVs to participants, redemption data is difficult to track in Tennessee. Once the WIC program in Tennessee incorporates an electronic balance transfer (EBT) system as other states have implemented for WIC, more data can easily be captured and analyzed. Once Tennessee incorporates an EBT system for their WIC program, then redemption of CVVs can be explored in all counties in Tennessee and trends can be identified for redemption among specific demographics.

It would have been ideal to implement this as a pilot study to initially examine the effectiveness of the vouchers. Since CVVs cannot be denied to women who qualify for the WIC program, it could be beneficial to have a study where the experimental group receives vouchers that differ in monetary value than the current package if funding was available. During the data collection period the CVVs were \$10 and \$6, but the amounts for CVVs were increased to \$11 and \$8 in 2015. If the dollar amount could be altered then this type of research could help determine if there is a dollar threshold per voucher where attitudes and behaviors were changed regarding fruits and vegetables.

The results of this research indicate that CVVs could potentially improve fruit and vegetable consumption, but this particular study does not show a significant increase from pretest to posttest fruit and vegetable consumption among women in the experimental group. Researchers could use the results of this investigation to develop future research studies for fruit and vegetable

consumption among low-income women. WIC could also explore additional interventions to ensure that providing vouchers with monetary value are the best way to increase fruit and vegetable consumption among women enrolled in the WIC program.

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APPENDICES

APPENDIX A

Demographic Form

Women, Infants, and Children (WIC) - About Me Section

Date: _____ Name: _____

Phone Number: _____ Age: _____

Number of Children: _____

Ages of others that live with you: _____

What is your highest level of education:

 Did Not Complete High School High School/GED Some College Bachelor's Degree Master's Degree, PhD or Advanced Degree

Is anyone in your home currently receiving WIC services now?

 YES NO

Are you currently pregnant?

 YES NO

Check one or more.

 Asian Native American Black or African American White

Hispanic?

 YES NO**Monthly Food Costs: \$ _____****Monthly Income: \$ _____**

APPENDIX B

Fruit and Vegetable Checklist

University of
California
Cooperative Extension

Fruit and Vegetable Checklist

These questions are about the ways you plan and fix food.
Think about how you usually do things.

Name _____

Date _____

ID# _____

 Entry
 Exit

Choose one answer for each question.

1.



Do you eat fruits or vegetables
as snacks?

- no
 yes,
sometimes
 yes,
often
 yes,
everyday

2.



Did you have citrus fruit or citrus juice
during the past week?

- yes
 no

3. Fruit: How much do you eat each day?

- none
 1/2 cup
 1 cup
 1 1/2 cups
 2 cups
 2 1/2 cups
 3 cups or more

4.  Do you eat more than one kind of fruit each day?
- no yes, sometimes yes, often yes, always

5.  Do you eat more than one kind of vegetable each day?
- no yes, sometimes yes, often yes, always

6. Vegetables: How much do you eat each day?



7.  Do you eat 2 or more vegetables at your main meal?
- no yes, sometimes yes, often yes, everyday

* Use the accompanying instruction guide when administering this tool.

* Research and development for this illustrated diet quality checklist were a joint effort of University of California (UC) Cooperative Extension, the California Nutrition Network, UC Davis Design Program and UC Davis Nutrition Department. Authors: Kathryn Sylva, Marilyn Townsend, Anna Martin, Diane Metz.

* The research for this diet quality instrument is available:

Townsend MS, Kaiser LJ, Allan LJ, Joy AB, Murphy SP. Selecting items for a food behavior checklist for a limited resource audience. *Journal of Nutrition Education and Behavior*. 2003;35:69-82.

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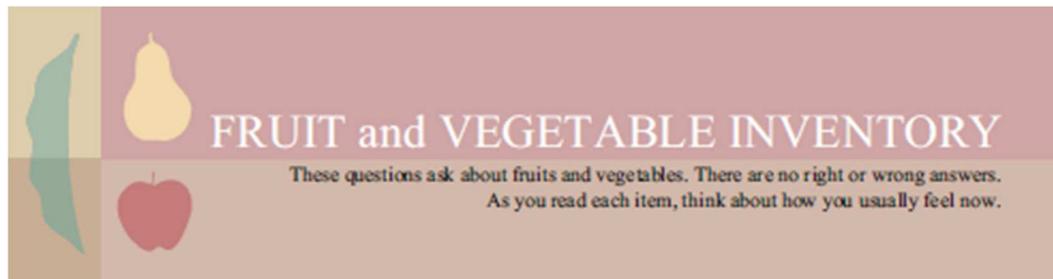
* The University of California does not discriminate in any of its policies, procedures, or practices. The University is an affirmative action/equal opportunity employer.

* Funded by the USDA Food Stamp Program via the Network for a Healthy California, UC Cooperative Extension, and the Clotewitz and Louise Pfeiffer Research Foundation through the Program in International and Community Nutrition, UC Davis.

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APPENDIX C

Fruit and Vegetable Inventory



FRUIT and VEGETABLE INVENTORY

These questions ask about fruits and vegetables. There are no right or wrong answers.
As you read each item, think about how you usually feel now.

ID# _____

Date ____/____/____

	Agree	Agree or Disagree	Disagree		
1. I feel that I am helping my body by eating more fruits and vegetables.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
2. I may develop health problems if I do not eat fruit and vegetables.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
<hr/>					
	Agree	Agree or Disagree	Disagree		
3. I feel that I can . . . eat fruit or vegetables as snacks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
4. I feel that I can . . . buy more vegetables the next time I shop.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
5. I feel that I can . . . plan meals or snacks with more fruit during the next week.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
6. I feel that I can . . . eat two or more servings of vegetables at dinner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
7. I feel that I can . . . plan meals with more vegetables during the next week.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
8. I feel that I can . . . add extra vegetables to casseroles and stews.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
<hr/>					
	Excellent	Very good	Good	Fair	Poor
9. How would you describe your diet?	<input type="radio"/>				

- | | I am | Shared decision | Other person |
|---|-----------------------|-----------------------|-----------------------|
| 10. In your household, who is in charge of what foods to buy? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 11. In your household, who is in charge of how to prepare the food? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
-

12. Mark one.

- I am not thinking about eating more fruit.
- I am thinking about eating more fruit ... planning to start within 6 months.
- I am definitely planning to eat more fruit in the next month.
- I am trying to eat more fruit now.
- I am already eating 3 or more servings of fruit a day.

13. Mark one.

- I am not thinking about eating more vegetables.
- I am thinking about eating more vegetables ... planning to start within 6 months.
- I am definitely planning to eat more vegetables in the next month.
- I am trying to eat more vegetables now.
- I am already eating 3 or more servings of vegetables a day.

• Funding provided by the Food and Nutrition Service, USDA, Grant #59-3198-6-046.

• Author: Marilyn Townsend and Lucia Kaiser. Graphic Designer: Lynn-Kai Chao. Nutrition Department, University of California Davis. This evaluation tool contains 13 psychosocial items shown to be related to fruit and vegetable intake. The 6 constructs are perceived benefits, perceived control, self-efficacy for eating fruit & vegetables, readiness to eat more fruit, readiness to eat more vegetables, and perceived diet quality.

• References

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Townsend MS, Kaiser LL. Brief psychosocial fruit and vegetable tool is sensitive for United States Department of Agriculture's nutrition education programs. *J Amer Dietetic Assoc*. 2007;107:2120-2124.

• Use this tool with a valid assessment of fruit and vegetable related behaviors such as the Fruit and Vegetable Checklist available at <http://townsendlab.ucdavis.edu/>. Instruction Guide is available for both tools at the same website.

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APPENDIX D

Tables

Table 1

Demographic Characteristics of WIC Participants ($N=93$)

	Waitlist Control Group ($n = 37$)	Experimental Group ($n = 56$)
	Mean (SD)	
Age (years)	24.5 (5.1)	22.6 (5.0)
Number of Children	1.03 (1.1)	0.64 (1.1)
Number of other adults in household	1.05 (0.71)	1.10 (0.87)
Monthly Food Cost (dollars)	362.31 (207.52)	316.27 (148.1)
Monthly Income	1253.93 (747.90)	1090.07 (907.9)
	<i>n</i> (%)	<i>n</i> (%)
Highest Level of Education		
Did Not Complete High School	4 (11%)	6 (11%)
High School/GED	17 (46%)	28 (51%)
Some College or Technical School	15 (41%)	20 (36%)
Bachelor's Degree	1 (3%)	1 (3%)
Ethnicity		
Asian	0 (0%)	2 (4%)
Native American	0 (0%)	2 (4%)
Black or African American	3 (8%)	1 (2%)
White	34 (92%)	51 (91%)

Table 2

Index Scores of WIC Participants

Index	Waitlist Control Group		Experimental Group Pretest		Experimental Group Posttest	
	Mean (SD)	<i>n</i>	Mean (SD)	<i>n</i>	Mean (SD)	<i>N</i>
Fruit and Vegetable Consumption	2.23 (0.55)	34	2.24 (0.48)	53	2.48 (0.61)	34
Perceived Benefit	0.73 (0.30)	37	0.78 (0.28)	56	0.85 (0.23)	34
Perceived Control	2.47 (0.54)	33	2.32 (0.63)	56	2.43 (0.48)	34
Self-efficacy	2.88 (0.20)	37	2.77 (0.38)	56	2.89 (0.16)	34
Fruit and Vegetable Amount	2.18 (1.05)	36	2.21 (0.92)	56	2.24 (0.91)	34

Table 3

One-way Independent Groups ANOVA Comparing Experimental and Control Groups on Fruit and Vegetable Consumption Pretest

Source	Sum of Squares	df	Mean Square	F	p
Between Groups	0.005	1	0.005	0.018	0.893
Within Groups	21.935	85	0.258		
Total	21.940	86			

Table 4

Results of One-Way ANOVAs Comparing Groups on Potential Continuous Covariates

Potential Covariate	<i>N</i>	<i>F (dfs)</i>	<i>p</i>
Age	111	1.92 (2, 108)	0.15
Monthly income	105	1.17 (2, 102)	0.32
Number of other adults in household	123	0.09 (2, 120)	0.92
Perceived Benefit	123	0.81 (2, 120)	0.45
Perceived Control	119	0.70 (2, 116)	0.50
Self-Efficacy	123	0.98 (2, 120)	0.38
Number of children	106	2.65 (2, 103)	0.08

Table 5

Results of Chi Square Tests Comparing Groups on Potential Categorical Covariates

Potential Covariate	N	Chi Square (df)	p
Education Level (4 levels)	121	4.02 (6)	0.67
Ethnicity (White/Minority)	123	1.73 (2)	0.42
Have A Child (yes/no)	106	8.13 (2)	0.02

Table 6

Descriptive Statistics for Subjects in Repeated-Measures ANOVA

	N	Pretest	Posttest
Subjects with children	10	2.33 (0.42)	2.54 (0.63)
Subjects without children	19	2.37 (0.43)	2.37 (0.52)
All Subjects	29	2.36 (0.42)	2.43 (0.56)

Note: Pretest and posttest scores are from the F&V Index created from the fruit and vegetable checklist.

Table 7

Tests of Normality

Variable	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	p	Statistic	df	p
F&V Consumption Pretest	0.121	33	0.200	0.968	33	0.427
F&V Consumption Posttest	0.152	33	0.052	0.961	33	0.271

Table 8

Within-subjects Effects for Pre-post Differences in Fruit and Vegetable Consumption

Source	Sum of Squares	df	Mean Square	F	p	Eta²
Pre-post Change	0.144	1	0.144	0.629	0.435	0.023
Pre-post Change X Child	0.144	1	0.144	0.629	0.435	0.023
Error	6.205	27	0.230			

Table 9

Between-subjects Effects Comparing Subjects With and Without Children

Source	Sum of Squares	df	Mean Square	F	p	Eta²
Intercept	302.3	1	302.3	1114.8	0.000	0.976
Have a Child (Y/N)	0.058	1	0.058	0.214	0.647	0.008
Error	7.323	27	0.271			

APPENDIX E

IRB Form

IRB
INSTITUTIONAL REVIEW BOARD
 Office of Research Compliance,
 010A Sam Ingram Building,
 2269 Middle Tennessee Blvd
 Murfreesboro, TN 37129



EXEMPT APPROVAL NOTICE

6/3/2015

Investigator(s): **Shayna Smith and Norman Weatherby**
 Department: Health and Human Performance
 Investigator(s) Email: sls7p@mtmail.mtsu.edu; normalweatherby@mtsu.edu
 Protocol Title: "The evaluation of a special supplemental program on attitudes and behaviors about fruit and vegetables among clients of the Women, Infants and Children (WIC) Program"
 Protocol ID: **15-184**

Dear Investigator(s),

The MTSU Institutional Review Board, or a representative of the IRB, has reviewed the research proposal identified above and this study has been designated to be EXEMPT.. The exemption is pursuant to 45 CFR 46.101(b) **(2) Educational Tests, Surveys, Interviews, or Observations**

The following changes to this protocol must be reported prior to implementation:

- Addition of new subject population or exclusion of currently approved demographics
- Addition/removal of investigators
- Addition of new procedures
- Other changes that may make this study to be no longer be considered exempt

The following changes do not have to be reported:

- Editorial/administrative revisions to the consent of other study documents
- Changes to the number of subjects from the original proposal

All research materials must be retained by the PI or the faculty advisor (if the PI is a student) for at least three (3) years after study completion. Subsequently, the researcher may destroy the data in a manner that maintains confidentiality and anonymity. IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Office of Compliance
 Institutional Review Board
 Middle Tennessee State University