DIETARY ADHERENCE: SOCIAL COGNITIVE THEORY AND THE MEDITERRANEAN DIET

By

BENJAMIN H. GREINER

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DIETARY ADHERENCE: SOCIAL COGNITIVE

THEORY AND THE MEDITERRANEAN DIET

Thesis Approved:

Julie Croff, Ph.D., M.P.H.

Thesis Adviser

Denna Wheeler, Ph.D.

Bridget Miller, Ph.D.

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Name: BENJAMIN H. GREINER

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Abstract:

Cardiovascular disease is the leading cause of death in the United States and is estimated to affect 1 in 3 Americans. The Mediterranean diet has proved to be efficacious in preventing and treating cardiovascular disease. The purpose of this study was to determine how psychosocial determinants affect cardiac patient abilities to adhere to the Mediterranean diet. Secondly, I sought to determine if prior knowledge, a proximal determinant to the SCT constructs, and familiarity with the diet affect diet quality. The final purpose was to analyze if socioeconomic variables affect a cardiac patient's cognitive capabilities for diet adherence. I used social cognitive theory (SCT) for the theoretical framework. A cross-sectional pilot study of cardiac patients was conducted at a large outpatient cardiology hospital. The results showed that dietary adherence was associated with improvements in the SCT constructs. Likewise, participants reporting familiarity with the Mediterranean diet consumed diets that were 11% healthier, on average, than those whom were unfamiliar. Finally, household income was the only socioeconomic variable associated with improvements in the SCT constructs. In conclusion, social cognitive theory, specifically self-efficacy, self-regulation, and perceived expected outcomes, were highly predictive of diet quality in cardiac patients. Prior knowledge of the diet was also associated with diet patterns that closely matched the Mediterranean diet, indicating that patient education plays a key role in dietary adherence.

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CHAPTER I

INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death in the United States and is caused primarily due to preventable behaviors. The Centers for Disease Control and Prevention estimated that heart disease is responsible for about 610,000 deaths per year with the majority of the cases being located in the southern states. Globally, cardiovascular disease accounts for 17.5 million annual deaths with around 75% of these occurring in low and middle income countries, according to the World Health Organization.

Diet has consistently been recognized as a significant source of CVD causation since the late 20th century and is one of three most modifiable risk factors, according to the World Health Organization (2015). The others are smoking and a sedentary lifestyle. The risk of a cardiac event independently attributed to unhealthy diet patterns has been estimated to be between 9% and 37% (Georgousopoulou, Pitsavos, Yannakoulia, & Panagiotakos, 2014). Specific diets have produced positive effects on the cardiovascular system; these diets are notably low in red meats and high in whole grains and nuts. The Mediterranean diet has filled this niche in the coastal European countries since the middle ages when the Romans modeled their diet after the Greeks in

bread, wine, oil, and fresh fish (Altomare et al., 2013). Today, the diet is characterized by the consumption of fatty fish and white meats, fruits and vegetables, whole grains, nuts, olive oil, and moderate wine consumption. The diet also limits the intake of red meats and processed carbohydrates.

Diet adherence is affected by multiple factors operating at individual, interpersonal, and organizational levels through self-generated cognitive aspects and external, environmental aspects. Social cognitive theory embraces the factors behind the decision to complete a behavior change through the use of functions that include self-efficacy, defined as one's perception that they are capable of completing a behavior for a desired outcome, self-regulation, social support, and perceived outcomes. The self-regulatory functions defined in social cognitive theory are mediated by internal, psychological thought processes and external, sociological factors. Perceived outcomes are latent expectations for an outcome that will result from completing a behavior. Social support is the psychological and physical aid offered by family, friends, and significant others. All of these constructs are proximally moderated by prior knowledge and preconceived notions of a given behavior that are often results of social and environmental cues. Thus, behaviorism, as theorized by social cognitive theory, is affected in response to stimuli that emerges from both individual forethought and the environment. Social cognitive theory has previously been used to better understand behavior changes including dieting (Anderson, Winett, & Wojcik, 2007), breast feeding (Handayani, Kosnin, & Jiar, 2016), job searching (Dahling, Melloy, & Thompson, 2013), physical activity (Harmon et al., 2014), and many others.

The primary objective of this pilot study was to analyze the cognitive characteristics affecting the uptake and adherence to the Mediterranean diet within the sample population. Furthermore, I aimed to differentiate between the social cognitive theory constructs to determine if some have stronger influences on adherence to the Mediterranean diet. Social cognitive theory states that self-motivation and self-belief, both key to conducting a behavior, are based on past

experiences and self-observation (Bandura, 1989). Thus, the second goal was to determine how prior knowledge of the Mediterranean diet affects one's ability to consume the diet. The final objective was to determine if certain populations have a higher percentage of those following the Mediterranean diet or have stronger self-regulatory capabilities than others.

It is hypothesized that lack of patient self-efficacy for diet adherence to the Mediterranean diet will have the greatest correlation with participants that are familiar with the diet but choose not to conduct the behaviors required to follow it. It is further hypothesized that one's lack of social support, perceived outcome expectations, and self-regulatory abilities will be correlated with the decision not to follow the Mediterranean diet, although, to a smaller degree than self-efficacy. Lastly, it is expected that minority or low income participants will have lower dietary adherence behaviors and self-regulatory mechanisms compared to the white participants.

CHAPTER II

BACKGROUND

Cardiovascular disease (CVD) is the leading cause of mortality in the United States with an overall death rate of 222.9 per 100,000 (Mozaffarian et al., 2015). CVD disproportionately affects males: the mortality rate was 269.8 per 100,000 for males and 184.8 per 100,000 for females in 2013. According to the National Center for Health Statistics (US), the age-adjusted number of heart disease deaths decreased by 30% in males and 32% in females from 2000 to 2010 (2014). Although the mortality rate is decreasing, the prevalence of CVD is increasing. This is likely due to improved, less invasive, and quicker cardiac event to cardiovascular intervention times and medications. Currently, about 1 in 3 Americans are estimated to have 1 or more types of CVD with 43.9% of the United States population projected to have 1 or more types of cardiovascular disease by 2030 (Mozaffarian et al., 2015).

Considering the 85.6 million Americans with more than 1 type of CVD and projected growth of CVD, the necessity to better understand the disease and the modifiable risk factors causing it is imperative. Cardiovascular disease is better defined in categories that include hypertension, congestive heart disease, peripheral vascular disease, and strokes (cerebrovascular

Disease). Congestive heart disease can then be further defined in myocardial infarctions, heart failures, and angina pectoris events. If all forms of cardiovascular disease can be limited through risk factor modification, a large number of potential years of life lost could be saved through decreased cardiac events.

CVD's economic impact in the United States was estimated at 17% of the overall national healthcare expenditures. Direct medical costs of CVD are estimated to increase from $272.5 billion to $818.1 billion between 2010 and 2030 (Heidenreich et al., 2011). Indirect costs, which are those due to years of productive life lost, are expected to increase from $171.7 billion to $275.8 billion in the same time period. This cost difference is related to decreased mortality rates associated with cardiovascular events as fewer people die due to improving medical care which reflects the overall costs of chronic, tertiary preventive medicine status post cardiac events.

RISK FACTORS

CVD is correlated with multiple behavioral risk factors with 80% of cardiovascular disease cases being preventable through behavior modification (Yang et al., 2012). The preventable factors include avoiding cigarette use, eating a healthy diet, exercising, and controlling lipid levels, diabetes mellitus, and hypertension. Moreover, the Cardiovascular Lifetime Risk Pooling Project, a meta-analysis with a sample size of 257,384 individuals, found that participants with no cardiovascular risk factors had a significantly lower chance of having a CVD event compared to those with 1 or more risk factors (Berry et al., 2012). Many other studies have confirmed these findings stating that fewer CVD risk factors, such as avoiding cigarette smoking and eating a healthy diet, relates to lower CVD prevalence and mortality (Yang et al., 2012; Folsom, Yatsuya, Nettleton, Lutsey, Cushman, & Rosamond, 2011; Ford, Zhao, Tsai, & Li, 2011).

Obesity

Obesity has a strong correlation with cardiovascular disease mortality as well as reduced life expectancy. As a risk factor, obesity is one that is preventable through diet and physical activity (Poirier et al., 2006). Figure 1 shows the correlation between subscapular skinfold thickness, a measure of obesity comparable to body mass index (BMI), and the occurrence of cardiac events. As BMI increases, the risk of having a cardiac event increases. BMI is used to define the level of fatness. A healthy BMI is 18.5 to 24.9 kg/m^2 while adults that are overweight are defined by a BMI of 25.0 to 29.9 kg/m^2. Obese adults have a BMI of ≥30.0 kg/m^2.

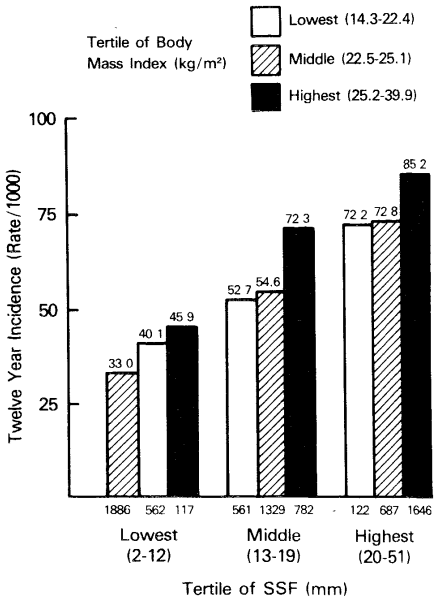

Figure 1: Twelve-year incidence rate of cardiac events versus subscapular skinfold thickness, a measure of central obesity, is shown. Retrieved from Donahue, Bloom, Abbott, Reed, and Yano (1987).

Oklahoma is the 6th most obese state in the United States: 32.2% of the adult population of Oklahoma is obese, and 12% of Oklahoma youth has a BMI greater than 30.0. Fifteen percent of the youth were overweight using the BMI scale (OSDH, 2014). Comparatively, the obesity rate in the United States was 27.6% during the same time frame. Obesity prevalence among adults increased from 23% to 36% from 1988-1994 and 2009-2010 (Fryar, Carroll, & Ogden, 2012). More recently, a 2011-2012 study with 9,120 participants found that there had been no significant changes in obesity prevalence in youth or adults between 2003-2004 and 2011-2012 (Ogden, Carroll, Kit, & Flegal, 2014). Although the obesity prevalence is no longer increasing, no studies were found indicating that it is decreasing. Therefore, to ensure the cardiovascular health of the United States, progress must continue to be made in initiating positive diet change.

Diet

Interestingly, multiple reports have found that consumption of saturated fats are not strongly

associated with cardiovascular disease when considering the saturated fat content in common food items like meat, eggs, and milk (Mente, de Koning, Shannon, Anand, 2009; Skeaff, Miller, 2009; Siri-Tarino, Sun, Hu, & Krauss, 2010). This finding may relate to the benefits of unsaturated fatty acids that also accompany saturated fatty acids in these foods, which counteract the CHD risk association.

A meta-analysis of 21 prospective cohort studies on the association between cardiovascular disease or stroke and saturated fat intake found that saturated fatty acids did not significantly change the cardiac outcomes of the 347,747 participants (Siri-Tarino et al., 2010). Rather, the study was supportive of the hypothesis that unsaturated fatty acids may counteract the negative effects of saturated fats. The study noted that the ratio of polyunsaturated fats to saturated (P/S) offered a relationship in projected cardiac events. Three of the 21 studies (Dayton, Pearce, Hashimoto, Dixon, & Tomiyasu, 1969; Leren, 1970; Turpeinen, Pekkarinen, Miettinen, Elosuo, & Paavilainen, 1979) determined that when the P/S ratio was much greater than the estimated threshold value of 0.49, that the risk for coronary heart disease was greatly reduced. Arntzenius (1985) found similar results when the P/S ratio was greater than 2.0.

Pure saturated fats, monounsaturated fats, and polyunsaturated fats are not consumed independently of one another. A 60 trial meta-analysis was conducted to review the effects of commonly consumed foods with their respective fatty acids (Mensink, Zock, Kester, & Katan, 2003). The study found that replacement of *trans* fatty acids, a potent form of saturated fatty acids from partially hydrogenated oils, with *cis* unsaturated fatty acids, especially polyunsaturated fatty acids, improved the lipid profile cardiac risk factor. Unsaturated fatty acids in rapeseed, soybean, and olive oils were found to have the best effects on reducing cardiovascular disease while tropical, saturated fats such as coconut fat resulted in greater risks of coronary artery disease due to increased total cholesterol to HDL cholesterol ratios, a common predictor of coronary artery disease (Arsenault et al., 2009)

Conversely, a study suggested that the glycemic index associated with carbohydrate consumption offered the best indications of the likelihood of developing CHD. This was confirmed when it was found that high glycemic index carbohydrates were more strongly associated with risk of CHD than was saturated fat intake (Jakobsen et al., 2010). Low to medium glycemic index carbohydrates were not correlated with CHD. Although, Siri-Tarino, Sun, Hu, and Krauss' 2010 meta-analysis found little epidemiologic data to support this finding. Another study found that the reduction and replacement of saturated fatty acids with carbohydrates reduced serum high-density lipoprotein concentrations while increasing serum triglyceride levels increased risk of CHD (Mensink & Katan, 1987). Collectively, these points indicate that the overall dietary pattern has a greater influence on cardiovascular disease risk than does individual dietary components (Baum et al., 2012).

MEDITERRANEAN DIET AND ATHEROSCLEROSIS

Having a diet high in unsaturated fatty acids from olive oil and nuts, fruits, vegetables, and fish, such as that in the Mediterranean diet, has shown to be effective at reducing the risk of myocardial infarctions, stroke, and death from cardiovascular causes (Estruch et al., 2013; Sofi, Abbate, Gensini, & Casini, 2010; Michel de Lorgeril et al., 1999). This finding was also observed in the 2002-2012 ATTICA study in which the Mediterranean diet offered a reduction in CVD risk, regardless of other risk factors that may have been affecting the patient's cardiac health (Panagiotakos et al., 2015). This indicates that the Mediterranean diet can be beneficial even in individuals with other risk factors related to CVD.

The Lyon Diet Heart Study (Michel de Lorgeril et al., 1999) and a cohort study by Extruch et al. (2013) also found that Mediterranean diet compliance over a 4-year and 3-year evaluation point, respectively, was largely maintained by the patients after having their first infarction. An earlier study found that dietary adoption and compliance is effective if the patient and patient's

social support system has been thoroughly educated and medical provider dietary surveillance is maintained throughout the dieting process (De Lorgeril et al., 1997). Therefore, physicians should not discount a patient's ability to adopt and comply with the Mediterranean diet nor should they allow dietary failure discouragement to hinder their willingness to recommend the Mediterranean diet for primary, secondary, and tertiary prevention of CVD.

Intake of vegetables, nuts, monounsaturated fatty acids, and overall dietary quality were inversely associated with coronary heart disease (Mente et al., 2009). Intake of high glycemic index foods and *trans* fatty acids was positively associated with CHD in this study. Using these findings, Mente concluded that the Mediterranean diet was the only diet associated with reduced cardiac risk.

Both the observational cohort study by Estruch et al. (2013) and the Women's Health Initiative Dietary Modification Trial with 48,835 participants (Howard et al., 2006) were comparable in their findings that a low-fat diet with increased fruits and vegetables did not result in any cardiovascular benefits. This reaffirms the point that the Mediterranean diet offers cardio-protective effects through extra virgin olive oil (Buckland et al., 2012), nuts, wine, fatty fish (Kris-Etherton, Harris, Appel, & Nutrition Committee, 2002), and legumes as these items were not supplemented in the low-fat, high fruit and vegetable diet but were the key nutrient sources in the Mediterranean diet.

THE PHYSIOLOGY OF ATHEROSCLEROSIS AND THE MEDITERRANEAN DIET

Recent evidence has shown that systemic inflammation, defined as inflammation affecting multiple organ systems and tissues, influences obesity, cardiovascular disease, and coagulatory responses (Chrysohoou, Panagiotakos, Pitsavos, Das, & Stefanadis, 2004; Morrow & Ridker, 2000; Libby, 2005; Vandanmagsar et al., 2011). Therefore, it is understood that if the unintentional systemic inflammatory response can be reduced, atherogenesis can be slowed and

cardiac risk factors decreased. A 2004 cross sectional study on over 3,000 men and women from Attica, Greece found that those with a strong adherence to the Mediterranean diet had a reduction in inflammation and coagulation markers, even after adjusting for age, smoking, physical activity, and BMI (Chrysohoou et al., 2004).

The various components of the Mediterranean diet affect the cardiovascular system differently. Fruits, vegetables, unsaturated fatty acids, whole grains, and alcohol (in wine) offer nutrients including vitamins B_6, B_{12}, C, and E, flavonoids, and beta-carotene; many of which have antioxidant and anti-inflammatory effects in the body. Wine presents as a particularly interesting food item. It is composed of antioxidant polyphenols, including quercetin and resveratrol (Perez et al., 2002), as well as ethanol that affects the cardiovascular system through mild vasodilation and increased HDL levels (Imhof et al., 2001).

PSYOCHOSOCIAL DETERMINANTS IN DIETARY ADHERENCE

Adherence to a cardioprotective diet and other behavior modifications is a challenge for many people attempting prevention. One study estimated that nonadherence failure rates for chronic illness care was 50% within the first year of initial behavior change and is due to psychological, social, and demographic factors (Delamater, 2006). Therefore, health behavior models and theories that consider these variables can be effective at addressing the barriers to adherence.

Social Cognitive Theory

Social cognitive theory (SCT), proposed by Albert Bandura, defines the self-influential processes that occur in the motivation and regulation of human behavior. Figure 2 shows a schematic of the SCT constructs. Bandura stated that neither intention nor desire alone are powerful enough to create behavior change. Rather, one must possess the capability for influence over his own behaviors and motivation, a concept defined as self-regulation. Through anticipatory and purposive actions, humans behave in manners that reflect internal and external influences.

External influences arise from the social environment one lives in while the internal influences are regulated by self-reflective, judgmental, and self-reactive capabilities that are innate in every decision maker. Social support, perceived outcomes, self-regulation, and self-efficacy act as mediators to the forethought that dictates one's reaction to the internal and external influences previously mentioned.

The self-regulating process, when considering achievements such as Mediterranean dietary adherence, is governed by three subfunctions. They include self-monitoring of one's behaviors, determinants, and the effects of these; judgement of one's behaviors based upon personal standards and environmental factors; and affective self-reaction (Bandura, 1991). Lastly, human behavior is centralized on the concept that one's beliefs about their capabilities to complete a behavior in expectance of a desired outcome. The self-efficacy function acts as a proximal determinant in one's behavioral self-regulation to further affect the distal subfunctions.

Dietary adherence, a health behavior, poses a problem in achieving and maintaining behavior change due to the health risk being delayed, without immediate effects, and being tied to social norms and other environmental factors. In further promoting the concept that intention to perform a behavior is not strongly associated with human behavior, Huffman et al. (2015) conducted a study on patients immediately following acute coronary syndrome events and their likelihood of being adherent to recommended diets, physical activity, and medications. They found that those without specific timelines and plans for behavior change were at higher risk for nonadherence. This finding was also confirmed by a meta-analysis on 47 studies that showed medium-to-large sized intention changes only led to small-to-medium changes in behavior (Webb & Sheeran, 2006). Therefore, SCT is used to understand the self-regulation function that decision makers subconsciously use in behavior choices, specifically dietary adherence for cardiovascular disease

prophylaxis.

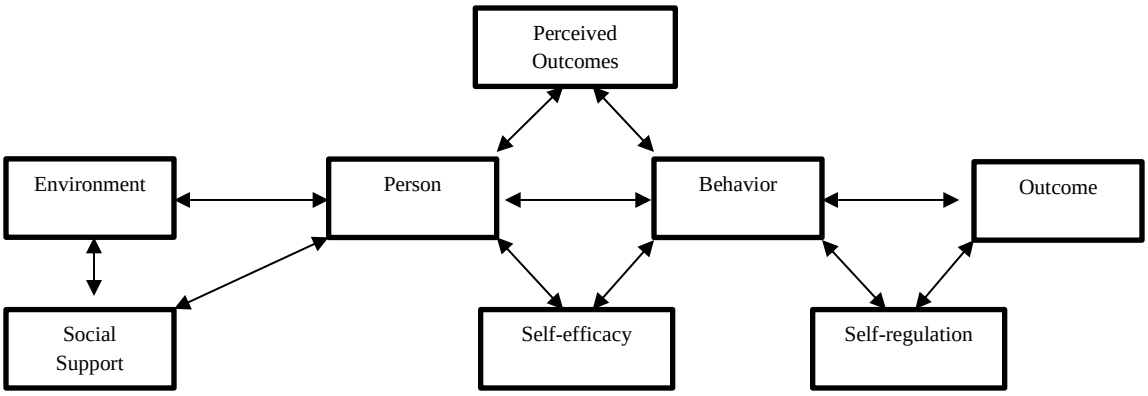

Figure 2: A schematic of the SCT construct and their relationships is shown.

Self-Monitoring Subfunction

Self-monitoring is the evaluation of one's own performances, the conditions affecting the performances, and the proximal and distal effects of these performances. This is the first of three subfunctions that influence human behavior. It is not only a personal evaluation of individual performance, but, also of preexisting systems and beliefs that are represented in one's memory when conducting a behavior, according to Bandura (1991). Through this subfunction, achievable goals and expectations can be created based upon the social and personal contexts. As a result of self-monitoring behavior, one's competency is either challenged or strengthened which relates to the affective reaction subfunction and the overall behavior as a whole.

Judgmental Subfunction

All behaviors are self-regulated as actions lead to reactions. This process of regulation of the personal standards and environmental factors behind how one reacts to an action is one of judgment. It is the determining factor into how one reacts to an action based upon whether it is viewed as favorable or unfavorable according to personal and social standards. The favorability of an action, behavior, or outcome is associated with previous experiences of both the self and social support members including family, friends, and close colleagues. If an action, such as

dieting for cardioprotective benefits, is poorly perceived by the social support system, then, the individual is less likely to produce a positive judgmental foundation towards the action; the decision maker will not react to the action with dietary adherence. Likewise, the perceptions of the determinants required to fulfill an action have influence on the judgmental process. Bandura stated that accomplishments based upon one's own abilities to complete the required determinants have a better impact on improving behavioral uptake and management.

Affective Self-Reactive Influence Subfunction

As a result of judgmental and self-monitoring functions, self-reactive influences are encouraged that develop one's conclusive course of action. These influences are accepted by the decision maker in anticipation of a desired outcome due to affective reactions that may be either tangible or self-controlled. A tangible influencer may be a gift, grade, or monetary prize while the self-controlled prize will be primarily that of a feeling of accomplishment or self-reward. Bandura exposed a particular interest in the self-reactive influence from self-incentives, a non-tangible reward. Self-incentives such as self-driven, achievable goals offer perceptions of success, forward progress, and accomplishment.

Self-Efficacy

A handful of studies have shown that individual circumstances have little to do with behaviors like unhealthy eating. Rather, the racial, cultural, psychosocial, and physical environments that surround an individual's built environment have the greatest impact on obesity rates and poor dieting (Ogden, Carroll, Kit, & Flegal, 2014; Wang, & Beydoun, 2007; Robert, & Reither, 2004). Therefore, it should be noted that dietary recommendations and dietary adherence will be more effective if a patient's psychosocial environment is considered when the Mediterranean diet is indicated for prevention.

Self-efficacy, a construct of Bandura's social cognitive theory, is the expectation that a given

task can be carried out using one's own abilities (Bandura, 1977). This behavioral construct has shown to be correlational with one's adherence in smoking cessation and in maintaining a weight loss program (Warziski, Sereika, Styn, Music, & Burke, 2008; DiClemente, 1981). When analyzing dietary choices, an increase in patient self-efficacy resulted in improvements of weight loss and better food choices, according to a 12-week study on young adults (Roach et al., 2003). The PREFER trial by Warziski et al. (2008) with a population of almost 90% women, found that self-efficacy ebbed and flowed based upon the positive reinforcement that was obtained at the weigh in appointments when the patient experienced weight loss, meaning a performance attainment. They also found that adherence to a fat gram goal was associated with weight loss, indicating that setting attainable and realistic goals can result in positive behavior acceptance and change in relation to dieting, although the results of this study may not generalize to men.

Self-efficacy is influenced through various demographic and socioeconomic factors that are necessary to consider when creating a patient specific diet regimen. A cross-sectional study showed that dietary self-efficacy in the patient was positively associated with staff-patient relationships and to improved compliance attitudes and behaviors (Zrinyi et al., 2003). Secondly, dietary self-efficacy was higher in older participants and females. From the social aspect, the number of family members living with a participant was inversely related to dietary self-efficacy. No significant difference was found in dietary self-efficacy when accounting for education or employment, although this may have been caused by a low sample size (n=107).

Self-efficacy is concurrently influenced by social support and outcome expectancies, as shown by Williams and Bond (2002). They found that social support was strongly related to diet specific self-efficacy, although, when self-efficacy was controlled, social support no longer had an effect on diet specific self-care. Self-efficacy was also moderated by outcome expectancies, meaning self-efficacy had greater benefits when combined with strong outcome expectations. However, low levels of self-efficacy and strong outcome expectations did not result in positive

behavior change. These findings indicate that when self-efficacy is present, both outcome expectations and social support can have positive effects on behavioral uptake and adherence.

SOCIOECONOMIC FACTORS

Socioeconomic Effects on Food Insecurity

One's diet is central to overall health and is often the first behavior that positively or negatively impacts our health. In order for one to adhere to a physician recommended cardioprotective diet, that individual must have access to healthy and affordable food. A 2009 meta-analysis concluded that individuals with limited access to supermarkets and healthy food venues were more likely to have poor dietary patterns and be clinically overweight (Larson, Story, & Nelson, 2009). Therefore, it is important to note the significant disparity that exists in the impoverished food desert communities.

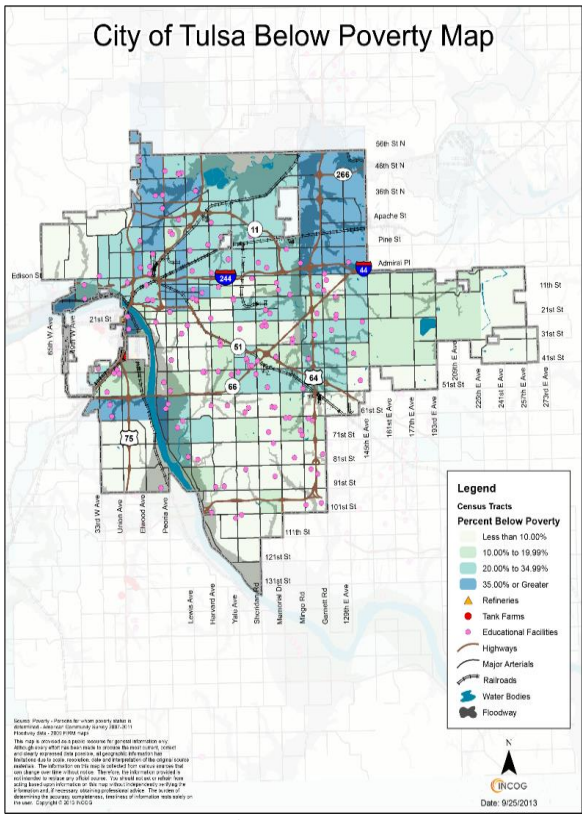

Figure 3: A poverty map of Tulsa is shown. North and downtown Tulsa have the highest percentage below poverty. Retrieved from https://www.cityoftulsa.org/media/343251/resilient%20cities%20grant%20map%20COT%20bdy.pdf

The United States Department of Agriculture defines food deserts as areas where the majority of the population has limited access to healthy and affordable food. Food deserts are especially prevalent in low income and racial/ethnic minority neighborhoods where supermarket access is severely limited. Over fifteen percent of Oklahoma's households are food insecure, meaning the family demonstrated difficulties in obtaining quality food for extended periods of time throughout the year (Coleman-Jensen, Gregory, & Singh, 2014). The same study showed that socioeconomic

status was a significant determinant of food insecurity. They found that 26.1% of households headed by blacks and 23.7% of households headed by Hispanics were food insecure. Lastly, 34.8% of low income households were food insecure. Overall, 14.3% of households were food insecure. Figure 3 shows a map of Tulsa with poverty rates overlaid on it. Next, Figure 4 is a representation of Tulsa with food deserts overlaid. These maps clearly indicate the association between poverty and food insecurities.

Socioeconomic Status and Chronic Diseases

Due to the effects diet has on one's health, the food insecurities of low socioeconomic populations can be extrapolated into multiple disease patterns, particularly obesity. Nelson, Gordon-Larsen, Song, and Popkin (2006) found that mixed race urban neighborhoods were at a higher risk for developing obesity and low income and minority groups were less physically active and more obese than their white counterparts. A study conducted using over 5,000 women with either food sufficient or food insufficient households analyzed whether this factor was associated with obesity and diet quality. The researchers found that women reporting a food insecurity had greater rates of overweight and also lower food quality. Specifically, they had lower healthy eating index (HEI) scores than their food secure counterparts in vegetable, fruit, milk, cholesterol, and food variety

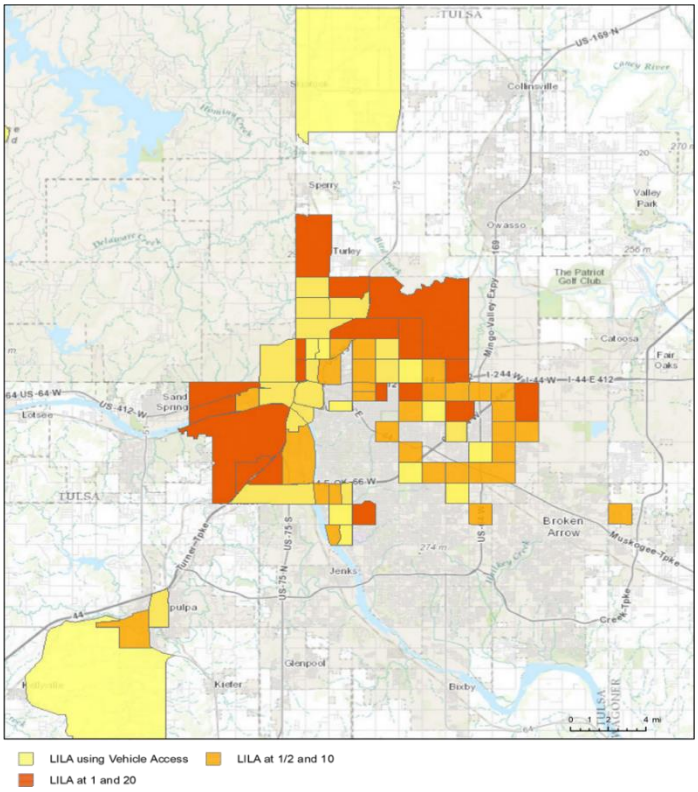

Figure 4: A Tulsa map including food deserts is shown. The majority of north Tulsa had limited income/access (LILA) to fresh produce with majority living greater than 1 mile (urban) or 20 miles (rural) from the nearest supermarket. Retrieved from http://www.ers.usda.gov/data-products/food-access-research-atlas/go-to-the-atlas.aspx.

consumption (Basiotis & Lino, 2003). This was similar to another study showing food security to be negatively correlated with HEI scores (Bhattacharya, Currie, & Haider, 2004). Finally, a 9 year follow up of 15,792 participants from the Atherosclerosis Risk in Communities Study found that residents of marginalized communities had greater incidence rates of coronary events even after controlling for occupation, income, and education (Roux et al., 2001). From these studies it is evident that income, occupation, race, and cultural background, all elements of socioeconomic status, impact obesity and cardiovascular disease morbidity and mortality. Therefore, socioeconomic status and food insecurities must be considered when creating clinical diet plans for minority individuals. This is especially true in Oklahoma where 31.9% of whites, 33.4% of Hispanics, and 38.3% of blacks are obese (Centers for Disease Control and Prevention, 2015).

CHAPTER III

METHODS

Background

A cross-sectional study was used to analyze the psychosocial effects influencing one's dietary adherence to the Mediterranean diet, according to social cognitive theory (SCT). To attempt to comprehend participant behavior, self-efficacy, self-regulation, perceived outcomes, and social support were selected to measure the proximal determinants affecting the SCT subfunctions: self-reflection, judgment upon one's behaviors, and affective self-reaction. The Food Beliefs Survey addressed these constructs which were key devices in measuring social cognitive theory (Bandura, 2004).

Survey

A modified form of the Food Beliefs Survey was piloted to measure the study objectives. This survey was previously validated and demonstrated good reliability in multiple studies (Anderson, Winett, & Wojcik, 2007; Anderson, Winett, & Wojcik, 2000; Anderson, Winett, Wojcik, Winett, & Bowden, 2001), although it has not been tested on the population of interest in this study. In the validating studies, principal axis factor analysis with oblique rotation was used

To determine the most correlational and reliable factor scores. Demographics were measured according to CDC guidelines (CDC, 2016).

Self-efficacy for increasing fruit, vegetable, olive oil, whole grains, and fish and decreasing red meat was measured using a 5 point Likert scale (1: certain I cannot, 5: certain I can). The participant was presented with 7 questions such as asking how certain that he or she can "eat at least 5 servings of fruits and vegetables daily," "eat 4-6 servings of whole grains per day," or "avoid eating red meat more than twice weekly" (Cronbach's α=0.809). Specific item factor loadings are shown in Table 1.

Self-regulation was also measured using a 5 point Likert scale (1: never, 2: once per month, 3: once per week, 4: a few times weekly, 5: almost daily) to measure participant ability to plan meals, avoid certain foods, and eat certain foods. This section was divided into self-regulation to choose the heart healthy food groups (Cronbach's α=0.815) and self-regulation to avoid sugary/highly processed and red meat foods (Cronbach's α=0.621). The former was analyzed using questions that included "In the past 3 months how often did you plan to eat fish at least 2-3 times per week" and "plan to eat 4-5 servings of fruit and vegetables per day". The latter used questions such as avoiding highly processed foods" and "planning to eat less red meat".

A validated social support scale was used that differentiated between the perceived support received from significant others (SO), family, and friends (Zimet, Dahlem, Zimet, & Farley, 1988). The internal reliability of the total social support scale was α=0.934. The division of social support into SO, family, and friends showed alpha scores of 0.961, 0.933, and 0.928, respectively. The reliability was calculated from a 5 point scale (1: very strongly disagree, 5: very strongly agree) that included questions like "my family really tries to help me," "there is a significant other who is around when I am in need," and "I can talk about my problems with my friends".

Lastly, perceived outcomes was measured using a 5 point Likert scale (1: strongly disagree, 5: strongly agree) and separated into positive perceived outcomes (Cronbach's α=0.906) and negative perceived outcomes (Cronbach's α=0.882). Four positive perceived outcome questions were asked that included when I eat healthy foods every day I expect, "I will have more energy," "my heart health will improve," "I will maintain a healthy weight," and "I will have a higher quality of life". Six negative perceived outcome questions were asked such as "the food I eat will not taste good" and "I will be bored with what I have to eat".

Table 1

Social Cognitive Theory Measures and Internal Consistency Estimates

SCT Construct	Description	Subdivision	No. of Items	α
Self-Efficacy	Perceived ability to perform a dietary behavior		7	0.809
Positive Perceived Outcome Expectations	Expectations of positive outcomes upon performing an action resulting from self-evaluation		4	0.906
Negative Perceived Outcome Expectations	Expectations of negative outcomes upon performing an action resulting from self-evaluation		6	0.882
Self-Regulation	Planning, using, and avoiding dietary behaviors in the past 3 months	Choose diet high in fruits, vegetables, fish, chicken, olive oil, nuts, and whole grains	9	0.815
		Avoid diet high in sugary, processed foods and red meat	3	0.621
Social Support	Self-perceived support from family, friends, and a significant other in daily activities		11	0.934

Sample Population

Systematic sampling was used to present the survey to every other potential participant over 3 weeks for sample collection. Three hundred and seventy-five surveys were given to a sample of patients with known or highly probable cardiovascular disease history from the Oklahoma Heart Institute – Utica Clinic. Fifteen of these were not returned and 23 had less than two thirds of the survey completed. Three hundred and thirty-seven participants remained for analysis. Cumulative sample demographics are shown in Table 2.

Gender	
Male	146
Female	154
Age (Years)	
Age Range	18-98
Mean	63.56
Median	65
Std. Deviation	13.48
Race	
White	245
Black	19
Hispanic	5
Asian	3
American Indian	44
Other	2

Table 2: Sample demographics.

Seventy-two patients refused participation in the survey. Thirty-eight percent were females and 62% were males. Subjective interpretation of the racial demographics for the 72 refusals were approximately: 79% white, 12% black, 6% Native American, and 3% Hispanic. Eyesight issues, lethargy, and "late for work" complaints were the most common reasons for refusal.

Protocol

Prior to collecting data, the research proposal was presented to and approved by the Hillcrest and Oklahoma State University Center for Health Sciences Institutional Review Boards. The OHI cardiology patients were approached as they arrived for their appointments and asked to participate in the study. At first patient contact, the purpose of the study was presented to the patient along with the Food Beliefs Survey. The choice to complete or not complete the survey was completely voluntary and voiced to the study participants. Completion of the survey acted as the consent form to use the answers for research at Oklahoma State University. No monetary incentives were offered for completion of the survey. Participants indicating no prior knowledge

or familiarity of the Mediterranean diet were excluded from the analysis between those that were familiar and followed the diet and those that were familiar but did not follow the diet.

Each answer selection from the Food Beliefs Survey resulted in a 1-point increase in a Mediterranean diet score with a possible range of 0 to 14; higher scores indicated a stronger relationship with the Mediterranean diet recommended food group consumption values. The point structure is as follows: whole grain serving consumption per day (0: 0 points, 1-2: 1 point, 3-5: 2 points, 6 or more: 3 points), vegetable serving consumption per day (0: 0 points, 1-3: 1 point, 4 or more: 2 points), fruit serving consumption per day (0: 0 points, 1-3: 1 point, 4 or more: 2 points), healthy fat serving consumption per day (0: 0 points, 1-3: 1 point, 4 or more: 2 points), frequency of seafood and chicken consumption per week (0: 0 points, 1: 1 point, 2 or more: 2 points), frequency of red meat consumption per week (0: 2 points, 1: 1 point, 2: 0 points), and glasses of red wine per day (0: 0 points, 1 or 2: 1 point, 3 or more: 0 points).

Subjects scoring between 1 and 4 were classified in the *"low dietary adherence"* group. Those with a Mediterranean diet score of 5 to 7 were grouped into the *"moderate dietary adherence"* group. Finally, participants receiving a score of 8 or more were classified in the *"high dietary adherence"* group. The Food Beliefs Survey is shown in Appendix 1.

Statistical Analysis

One-way Analysis of Variance (ANOVA) tests were used to determine if statistically significant differences existed among the three diet adherence groups compared to self-efficacy, outcome expectations, self-regulation, and social support. ANOVA was also used to analyze differences in race, income, and education levels with the constructs of interest. Tukey's HSD post hoc analysis was used to determine specific pairwise differences after a significant ANOVA finding. A One-sample t test was used to measure the difference between the sample and population age. Chi-Square Goodness of Fit tests were used to compare nominal variables

(gender and race) of the sample to the total OHI-Utica population over the past 3 years. Statistical analyses were conducted using IBM SPSS version 23.

CHAPTER IV

RESULTS

Sample Demographics and Statistical Power

Of the survey respondents, 48.7% were male. A Chi Square Goodness of Fit test (Table 2) indicated that this was not significantly different than the total OHI-Utica population (X^2=0.003, p=0.954). The sample race and ethnicity was significantly different from the expected population (X^2=11.63, p=0.02). The sample's mean age was 63.56 (SD=13.48) years. The population mean age was 60.77 (SD=16.28) years over the past 3 years at the OHI-Utica office. One-sample t test analysis showed the sample participants were significantly older than the clinic population (t(264)=3.367, p=0.001). Statistical power was calculated to be 75% with a Cohen's d effect size of 0.49 at the weakest statistically significant difference for this study.

	Sample	Expected Based on Population	Total Population (2013-2016)	Percent Observed	Chi Square Goodness of fit / Independent t test
Gender					
Male	146	145.5	14475	48.7%	X^2=0.003, p=0.95
Female	154	154.5	15362	51.3%	
Age (Years)					
Age Range	18-98		1-103		t(270.9)=3.347 ,p=0.001
Mean	63.56		60.77		
Median	65.00		63.00		
Std. Deviation	13.48		16.28		
Race					
White	245	227.5	21521	77.0%	X^2=11.630, p=0.02
Black	19	20.1	1898	6.0%	
Hispanic	5	4.3	356	1.6%	
Asian	3	1.5	140	0.9%	
American Indian	44	24.6	2328	13.8%	

Table 3 Sample demographic results.

SCT Constructs and Mediterranean Diet Followers

The 6 social cognitive theory constructs measured by the Food Beliefs Survey were analyzed using One-way Analysis of Variance to determine whether a significant difference existed between high, moderate, and low adherence groups to the Mediterranean diet. ANOVA testing of positive perceived outcomes revealed a significant difference between the 3 adherence groups ($F(2, 303)=5.363$, $p<0.01$). Tukey's HSD post hoc analysis showed a statistically significant difference ($p<0.01$) between the high adherence group ($M=4.46$, $SD=0.78$) and the low adherence group ($M=3.91$, $SD=1.06$). The difference between the high and moderate adherence groups did not result in statistical significance.

One-way ANOVA also revealed a statistically significant difference between the adherence groups in negative perceived outcomes ($F(2, 301)=16.916$, $p<0.001$). Post hoc analysis showed that the low adherence group ($M=3.12$, $SD=0.93$) and moderate adherence group

(M=2.77, SD=1.04) were significantly higher ($p<0.001$) than the high adherence group (M=2.03, SD=1.05), indicating poorer self-perceived ability to overlook the poor expectations in the lower adherence groups. There was no significant difference between the moderate and low adherence group at the 95% confidence interval.

Following positive and negative perceived outcome expectations, social support was analyzed in the low, moderate, and high adherence groups. ANOVA reported no statistically significant difference ($p>0.05$) between the three groups. Figure 5 represents this lack of significance by the lack of change between Mediterranean diet adherence group and mean social support.

The self-regulation construct was divided into two groups: those that chose to consume a diet high in fruits, vegetables, white meat, whole grains, and olive oil over the past 3 months (healthy option) and participant self-regulation to avoid a diet high in sugary, processed foods and red meat over the same period (unhealthy option). One-way Analysis of Variance tests were conducted and found a significant difference ($F=25.205$, $df=(2, 303)$, $p<0.001$) between the groups in self-regulation to choose the healthy food options. Pairwise testing using Tukey's HSD post hoc analysis revealed statistically significant differences between all 3 adherence groups ($p<0.001$). The mean self-regulation scores improved with each adherence group; low adherence had a mean of 2.40 ± 0.73, moderate adherence had a mean of 3.01 ± 0.83 and the high adherence group showed a mean of 3.54 ± 0.68.

Analysis of Variance testing also revealed a significant difference between the 3 groups in self-regulation to avoid unhealthy food groups like highly processed, sugary foods and red meats ($F(2, 317)=10.947$, $p<0.001$). Consequently, Tukey's HSD post hoc analysis was used to

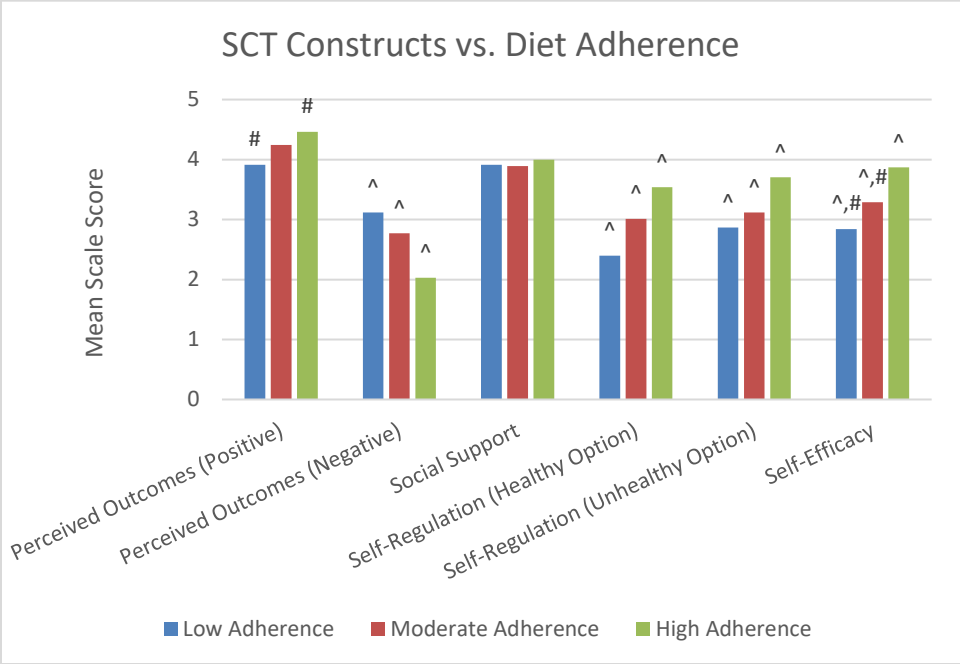

Figure 5: The mean social cognitive theory construct scores are shown against the low, moderate, and high dietary adherence groups. ^ indicates p<0.001. # indicates p<0.01.

determine where the significant difference existed. This analysis showed that the low and moderate adherence groups were statistically lower than the high adherence group ($p<0.001$), although, the low and moderate groups were not significantly different than each other. The low, moderate, and high adherence groups had respective means of 2.87 (SD=0.92), 3.12 (SD=1.01), and 3.70 (SD=1.04).

The final SCT construct analyzed against Mediterranean diet adherence was self-efficacy. ANOVA testing showed a statistically significant difference between the 3 adherence groups ($F=20.766$, $df=(2, 307)$, $p<0.001$). Post hoc testing showed a significantly different result between all 3 pairwise tests. The low and moderate adherence groups were significantly different from the high group ($p<0.001$) and the low group differed from the moderate adherence group ($p<0.01$). Comparable to the other constructs, self-efficacy increased as diet adherence increased. The low adherence group had a mean score of 2.84 (SD=1.00), the moderate adherence group had a mean score of 3.29 (SD=0.84), and the high adherence group resulted in a mean of 3.87 (SD=0.62).

Mediterranean Diet Familiarity and Diet Patterns

A One-way ANOVA test was conducted to determine whether familiarity with the Mediterranean diet resulted in greater likelihood of consuming the diet of interest. The result of this test showed a significant difference between the low, moderate, and high Mediterranean diet adherence groups and the self-reported familiarity with the diet ($F(2, 334)=7.571$, $p=0.001$). Participants with high dietary adherence were significantly more likely to be familiar with the Mediterranean diet compared to the low adherence group ($p=0.001$) and the moderate adherence group ($p<0.05$), as found by post hoc analysis. The mean diet scores for participants familiar with the diet was 6.68 (SD=1.53). The mean diet scores for participants unfamiliar with the Mediterranean diet was 5.96 (SD=1.58) or 11% lower. Figure 6 shows the percentage of the sample that was familiar and not familiar with the Mediterranean diet.

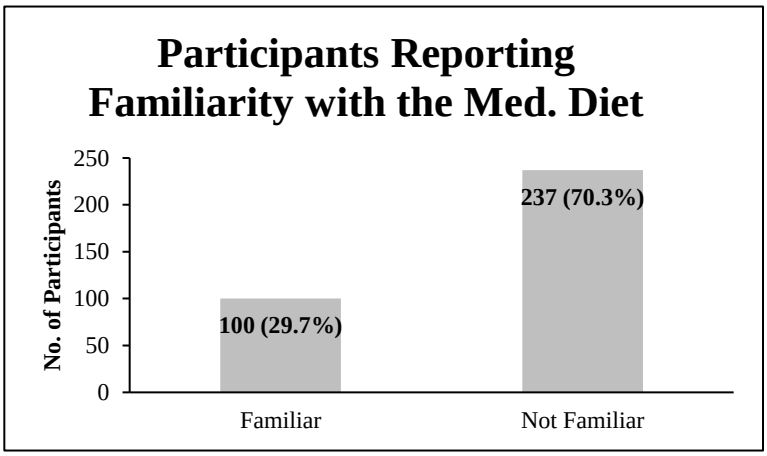

Figure 6: Number of participants reporting familiarity to the Mediterranean diet is shown.

Race Effects on SCT Constructs

One-way Analysis of Variance was conducted on the 7 racial and ethnic categories against the social cognitive theory constructs. Testing for the positive perceived outcomes showed no significant difference ($p>0.05$) between the groups. Likewise, ANOVA reported no differences among the racial categories for negative perceived outcome expectations. Tukey's HSD planned comparison between the racial and ethnic minorities against whites also found no statistically significant differences pairwise.

Following perceived outcomes, social support and self-regulation were analyzed. ANOVA reported no significant differences between races for the mean social support scale item. One-way Analysis of Variance testing for differences in self-regulation to choose the healthy food option and self-regulation to avoid the unhealthy food option both revealed no statistically significant differences in race. However, blacks appeared to have less self-regulation than whites in avoiding highly processed, sugary foods and red meats (M_{black}=2.82, SD=0.89 and M_{white}=3.24, SD=1.03) whereas the 2 races were nearly equivalent in self-regulation to choose the healthy food option (M_{black}=2.98, SD=0.95 and M_{white}=3.02, SD=0.83). Finally, self-efficacy to maintain or uptake the Mediterranean diet versus race was analyzed using Analysis of Variance. No statistically significant differences existed between the races in the self-efficacy construct.

Income Effects on SCT Constructs

The sample's income frequencies are shown in Table 4.

Self-reported income brackets were used to test for differences in the social cognitive theory constructs. One-way Analysis of Variance was used to determine the difference between the groups and Tukey's HSD post hoc analysis was used to find pairwise differences between the highest income bracket and the lower brackets. Table 4 shows the income demographics.

Income	Number of Participants
<15,000	49
15,000-25,000	47
25,000-35,000	24
35,000-50,000	31
>50,000	130
Total	337

Table 4: Self-reported income frequencies are shown above.

First, positive and negative perceived outcome expectations were analyzed for significant differences in the income groups. ANOVA revealed a statistically significant difference between the income groups for positive perceived outcomes ($F(4, 267)=2.644$, $p<0.05$). However, post hoc testing did not show a significant difference pairwise between the groups. In contrast to the positive perceived outcome item, the

mean negative perceived outcome scale showed no statistically significant difference between the income brackets.

Following perceived outcome expectations, social support was tested among the income groups. ANOVA revealed a statistically significant difference between the groups ($F(4, 252)=8.660$, $p<0.001$). Tukey's HSD post hoc analysis showed the groups making less than $15,000 ($p<0.001$), between $15,000-25,000 ($p=0.001$), and between $25,000-35,000 ($p<0.05$) were statistically different than the income group making greater than $50,000 yearly. The mean social support scale item for those making less than $15,000 was 3.45 (SD=1.01) while the group making between $15,000-25,000 was 3.55 (SD=1.28). The income group reporting between $25,000-35,000 per year household income had a mean of 3.52 (SD=1.34) and, finally, the greater than $50,000 income group had a mean scale score of 4.30 (SD=0.88).

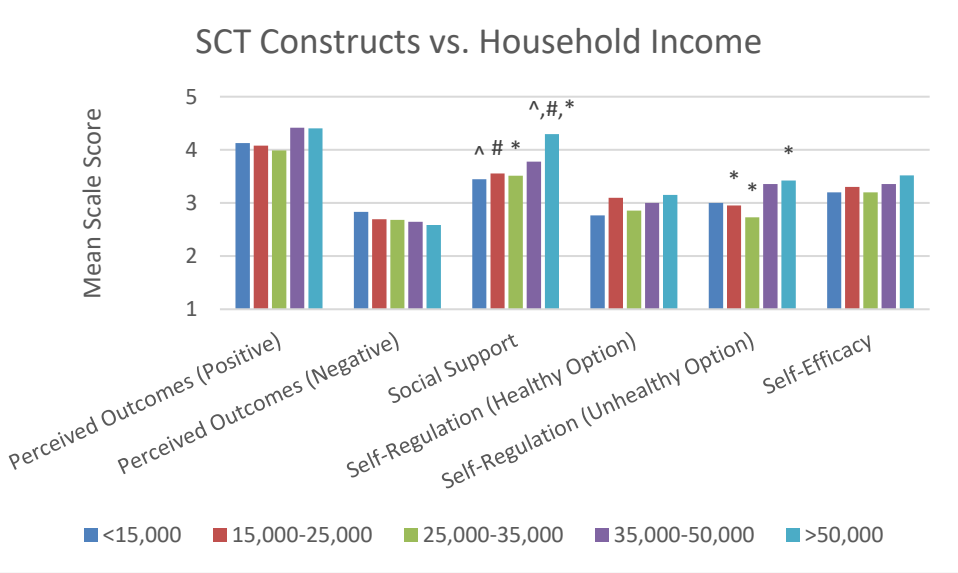

Table 5: Household income levels compared to the mean scale scores is shown above. ^ indicates $p<0.001$. # indicates $p<0.01$. * indicates $p<0.05$.

Self-regulation to choose the healthy food option did not show statistically significant results among income brackets using ANOVA. Conversely, self-regulation to avoid the unhealthy food option was directly proportional to income and resulted in statistical significance between groups ($F(4, 263)=4.085$, $p<0.01$). Participants in the $15,000-25,000 group (M=2.95, SD=0.97) were significantly lower than those in the greater than $50,000 group (M=3.42, SD=0.91,

p=0.05). Likewise, the $25,000-35,000 group (M=2.72, SD=1.08) reported statistically significant lower self-regulation than the greater than $50,000 group (p<0.05). Self-efficacy did not reveal statistical significance between the income groups. Comparisons of SCT constructs by household income group are shown in Figure 7.

Education Effects on SCT Constructs

Five education levels were tested against the SCT constructs using One-way Analysis of Variance and Tukey's HSD post hoc analysis when a significant difference was observed. The sample frequencies are shown in Table 5.

Education	Number of Participants
Some High School	22
High School Graduate	111
Associate's Degree (or Technical School)	79
College Graduate (Bachelors)	59
Graduate Degree	37
Total	308

Table 6: Self-reported frequency of education attainment for the sample is shown above.

Mean scaled scores for positive perceived outcome expectations revealed no statistically significant differences between the education levels. In considering negative outcome expectations, high school graduates had higher scores (M=2.77, SD=1.11) than did those with a graduate degree (M=2.22, SD=1.00), although, statistical significance was neither reached between the groups nor pairwise. Comparable to the improvements noted in positive perceived outcomes as education increased, negative perceived outcomes decreased as education attainment increased but ANOVA showed no significant difference between the groups.

Following ANOVA testing of perceived outcomes, social support and self-regulation were analyzed. No statistically significant difference was noted between social support and education attainment. Self-regulation to choose Mediterranean diet healthy food options showed positive correlations as educational attainment increased, although, a statistically significant difference between the groups was not found (p=0.051). Self-regulation to avoid unhealthy food

options also did not reach statistical significance in finding a difference between the education levels. Finally, ANOVA was used to test for a difference between self-efficacy and education level. The variance test revealed no significant difference between the groups ($p>0.05$). Figure 7 shows the trends between educational attainment and the SCT constructs.

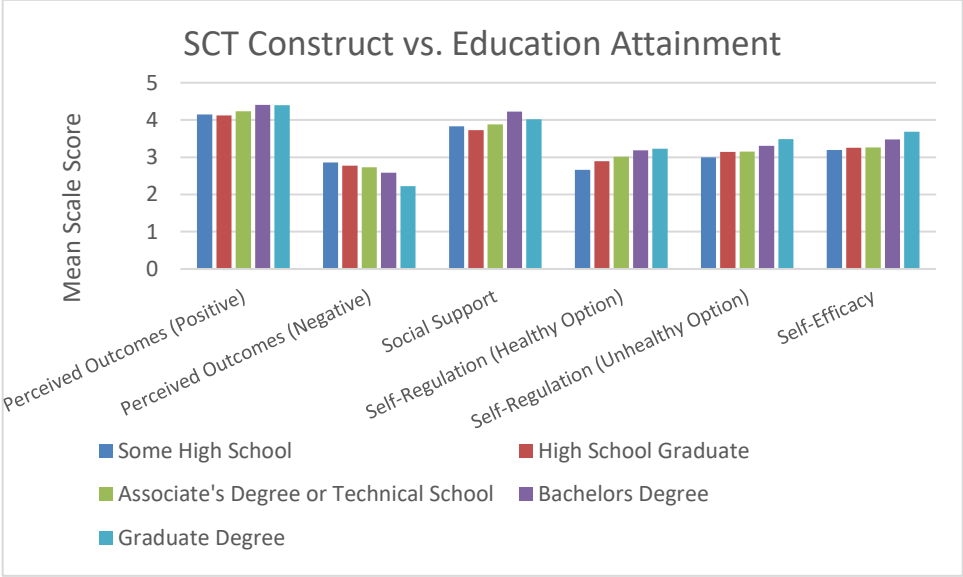

Figure 7: Highest education level obtained compared to the SCT scales is shown. No significant difference was found between the groups.

CHAPTER V

DISCUSSION

Social cognitive theory states that behaviorism is mediated by specific constructs as a result of a latent, cognitive response to an internal or external stimulus. These constructs are self-efficacy, self-regulation, perceived outcomes, and social support. This cognitive response is often formed based upon preconceived notions and past experiences with the stimulus and ultimately leads to the conscious decision to perform a behavior. This pilot study showed that the SCT constructs were highly predictive of cardiology patient abilities to consume food groups resembling the Mediterranean diet. Moreover, participants reporting familiarity with the Mediterranean diet were more likely to consume a heart healthy diet than unfamiliar participants, further justifying the use of SCT for developing diet interventions. Lastly, income, a measure of the socioeconomic status, acted as a determinant in the SCT constructs.

Dietary Adherence and the SCT Constructs

The dose-response relationship between participants consuming Mediterranean diets with high adherence showed improvements in all measured constructs, excluding social support. Positive perceived outcomes were significantly higher in patients with high dietary adherence. Negative perceived outcomes were lower in the high diet adherence group than the moderate and low adherence groups, indicating the high Mediterranean diet consumers perceive that they will have fewer adverse issues when consuming the Mediterranean diet. Participants with high dietary adherence were also more likely to have higher self-regulation in both consuming a diet high in fruits, vegetables, nuts, whole grains, and fish and in avoiding highly processed, sugary foods and red meats compared to low and moderate dietary adherence participants. Finally, low, moderate, and high exposure to the Mediterranean diet all resulted in stepwise improvements in dietary self-efficacy. Social support did not reveal statistically significant values when considering the three diet groups.

Figure 5 shows that social support had little to no gradient for improvement between the groups. This is may have occurred due to the patient population having a chronic disease that is highly prevalent in the elderly population; there is little external support for heart disease compared to other diseases that draw more attention from the media such as breast cancer and amyotrophic lateral sclerosis (ALS). Significant others, friends, and family may have also perceived the development of heart disease as a fault of the patient's lack of ability to lose weight or quit smoking, both heart disease risk factors, over many years. This perception of fault may not be present in diseases that manifest from an unknown etiology or genetic abnormality so more social support may be provided resulting in improved outcomes (Banik, Luszczynska, Pawlowska, Cieslak, Knoll, & Scholz, 2016).

Self-regulation to consume the healthy option had the largest mean difference at 1.14 between the low and high dietary adherence groups while negative perceived outcomes and self-efficacy were close behind at 1.09 and 1.03, respectively on a five-point scale. Thus, self-

regulation, negative perceived outcomes, and self-efficacy seemed to have the largest association with participants in the low, medium, and high Mediterranean diet adherence groups. These findings were synonymous to other studies in which self-efficacy, perceived outcomes, and self-regulation were key mediators in diet adherence (Anderson, Winett, & Wojcik, 2007; Schwarzer & Renner, 2000; Hamilton, Vayro, & Schwarzer, 2015). Although the perception of positive outcomes upon eating heart healthy foods showed statistically significant higher values in the high diet adherence group compared to the low group, the mean difference was only 0.55 points. This likely reduced the clinical relevance associated with positive perceived outcomes in Mediterranean diet adherence interventions for cardiac patients. Clinical relevance may have also been limited for self-regulation to avoid unhealthy food groups as the mean difference was 0.83 between the high and low adherence groups.

Mediterranean Diet Familiarity and Diet Patterns

Social cognitive theory posits that past experience and prior knowledge acts as a proximal determinant for self-regulation, perceived expected outcomes, and self-efficacy. As a result, prior knowledge, or familiarity with the Mediterranean diet, should be indirectly associated with diet performance. This study confirmed this hypothesis in finding that participants with high dietary adherence to the Mediterranean diet were significantly more likely to be familiar with the diet than participants in the low and moderate diet adherence groups. In comparing the diet scores of participants familiar with and not familiar with the Mediterranean diet, patients reporting familiarity received a diet score that was, on average, 11% higher than those that were not familiar with the diet. This indicates that being familiar with the Mediterranean diet results in healthier diet patterns. Therefore, and in addition to the finding that less than one third of the sample was familiar with the Mediterranean diet, patient education on heart healthy dieting should be emphasized in the physician's clinic.

Socioeconomic Factors and the SCT Constructs

Most likely due to the small number of minority participants and lack of power to make comparisons, race did not appear to have an impact on any of the constructs. This result contrasted the difference that was expected based upon the poor diet quality in blacks and Hispanics of other studies (August and Sorkin, 2011; Wang and Chen, 2011).

Income had the largest effects on the SCT constructs compared to all other SES factors. However, perceived outcomes and self-efficacy were not affected by this factor. No income bracket was found to be associated with positive or negative perceived outcomes in this study. Social support, alternatively, showed a positive linear relationship as income increased. This was comparable the findings of another study that showed social support to have a positive correlation with income with consideration for diet patterns, albeit less so than the self-efficacy construct (Ball, MacFarlane, Crawford, Savige, Andrianopoulos, & Worsley, 2009). Although, in the present study, social support was not statistically associated with Mediterranean diet adherence. Lastly, self-regulation to avoid unhealthy foods was directly proportional with income brackets. These findings suggest interventions should focus on the high risk, low income populations.

The final SES factor studied was education level. The findings showed that perceived outcomes, self-regulation, and self-efficacy improved as education attainment increased. However, the increases were not statistically significant and, as a result, may not be clinically significant.

Limitations and Weaknesses

Due to the nature of cross-sectional studies being observational as opposed to interventional, the external validity of this study could not be assured as unknown confounders and uncontrolled variables may have been at play. Further studies in diet adherence using social cognitive theory for patient populations outside of the cardiac clinics would be required to make

efficacy determinations in the clinical environment. Some weaknesses in the study design are also noted. The study did not account for patients with gluten intolerance or patients on anticoagulation therapy with warfarin, which both require modified diets of whole grains and vegetables plus red wine, respectively. This would have skewed the diet scores down for these participants whom could not receive as many points from these food groups as others. Another limitation for this study that may be harmful for internal validity was the sample age and race demographics. The sample mean age was statistically different and almost 3 years greater than the total OHI-Utica population. Likewise, the race and ethnicity demographics were significantly different than expected which likely offers reason for the finding that race did not affect the SCT constructs. Increasing the sample size would have improved the age and racial representation of the sample compared to the population.

Implications for Interventions and Further Research

The results of this study indicate that further research is necessitated in the use of social cognitive theory and Mediterranean diet consumption in cardiac patients to gain external validation and clinical confidence in the use of SCT for diet education. Future studies should also consider how to best improve the SCT constructs in cardiac patients and perhaps consider how message framing affects these constructs. Although this study does not offer specific suggestions for improving self-efficacy, self-regulation, and perceived outcomes, it proposes that if accomplished, heart healthy diet consumption can be improved through interventional trials. The results of the present study also suggest that significant focus should remain on improving the SCT constructs in low income individuals and possibly racial minority cardiac patients.

CONCLUSION

In conclusion, study participants with high, moderate, and low dietary adherence to the Mediterranean diet were found to report proportional scores for the social cognitive theory constructs, excluding social support. These findings indicated that self-efficacy, perceived outcomes, and self-regulation act as determinants for a cardiac patient's ability to uptake and maintain the Mediterranean diet. Social support was not found to affect the dieting capabilities of the population of interest. The proximal determinant for the SCT constructs, prior knowledge of the Mediterranean diet, was also associated with healthier diet patterns. Therefore, patient education on proper dieting would presumably improve healthy diet consumption. Finally, household income was the primary socioeconomic variable found to influence the SCT constructs. Social cognitive theory proved to be an effective tool in understanding cardiac patient dietary behaviors and should be considered for dietary behavior interventions and further research. Cardiac patients with high self-efficacy, self-regulation, positive perceived outcomes and low negative perceived outcomes are likely to develop and maintain heart healthy diet patterns that will ultimately prevent and reduce cardiovascular disease.

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APPENDICES

Appendix 1: The Food Beliefs Survey is on the following page to preserve the format.

Appendix 2: Institutional Review Board Letters

Master of Public Health Program
Oklahoma State University

Food Beliefs Questionnaire

Approved by the OSU and Hillcrest IRB

This questionnaire is voluntary and anonymous. Oklahoma Heart Institute does not require you to complete this survey. Its use is for research purposes at the Oklahoma State University Graduate College. Your answers will not affect the medical treatment you receive at Oklahoma Heart Institute. By completing this survey, you declare that you are 18 years or older and consent to use your answers for research by the OSU Graduate College.

I thank you for being truthful with your answers.

1. Who is completing this survey?	Patient Spouse Parent Child
2. Is the person completing the survey the primary meal prepper in the house?	Yes No
3. Does the patient have diabetes?	Yes No
4. Are you familiar with the Mediterranean (heart healthy) diet? **(If no, skip to question 7)**	Yes No
5. Is your diet comparable to the Mediterranean diet?	Yes No
6. Have you tried eating the Mediterranean diet in the past?	Yes No
7. How many servings of whole grains do you eat per day? (1 serving = 1 whole grain sliced bread, ½ cup rice or pasta)	0 1-2 3-5 6 or more
8. How many servings of vegetables do you eat per day? (1 serving = 1 cup leafy vegetables, ½ cup cut up vegetables, ½ cup vegetable juice)	0 1-3 4 or more
9. How many servings of fruit do you eat per day? (1 serving = 1 medium fruit or ½ cup fresh, frozen, or canned fruit)	0 1-3 4 or more
10. How many servings of healthy fat do eat per day? (1 serving = 1tsp olive oil, ½ handful of raw nuts, 1 Tbsp peanut butter)	0 1-3 4 or more
11. How many times per week do you eat fish, seafood, or chicken?	0 1 2 or more
12. How many times per week do you eat red meat like beef or pork?	0 1 2 or more
13. How many glasses of red wine do you drink per day, on average?	0 1 2 3 or more

Please base the following answers on the patient's perspective if a family member or friend is completing the survey.

Please use this scale to answer the following questions:

1	2	3	4	5
Very strongly disagree		**Neutral**		**Very strongly agree**

1. There is a significant other who is around when I am in need.	**1 2 3 4 5**
2. There is a significant other with whom I can share my joys and sorrow.	**1 2 3 4 5**
3. My family really tries to help me.	**1 2 3 4 5**
4. I get the emotional help and support I need from my family.	**1 2 3 4 5**
5. I have a significant other who is a real source of comfort to me.	**1 2 3 4 5**
6. My friends really try to help me.	**1 2 3 4 5**
7. I can talk about my problems with my family.	**1 2 3 4 5**
8. I have friends with whom I can share my joys and sorrows.	**1 2 3 4 5**
9. There is a significant other in my life that cares about my feelings.	**1 2 3 4 5**
10. My family is willing to help me make decisions.	**1 2 3 4 5**
11. I can talk about my problems with my friends.	**1 2 3 4 5**

Use this scale to tell us how often in the past 3 months you did the following:

1	2	3	4	5
Never	**Once per month**	**Once per week**	**A few times per week**	**Almost every day**

In the past 3 months how often did you:	
1. Eat at least 6 or more servings of foods like whole grain bread, brown rice, or whole wheat pasta per day.	**1 2 3 4 5**
2. Eat at least 4-5 servings of fruit and vegetables per day.	**1 2 3 4 5**
3. Avoid highly processed foods like chips and cookies.	**1 2 3 4 5**
4. Plan to eat less red meat like beef and pork.	**1 2 3 4 5**
5. Eat fish at least 2-3 times per week.	**1 2 3 4 5**
6. Plan to eat fish at least 2-3 times per week.	**1 2 3 4 5**

Use this scale to tell us how often in the past 3 months you did the following:

1 Never	2 Once per month	3 Once per week	4 A few times per week	5 Almost every day

In the past 3 months how often did you:	
7. Plan to eat 6 or more serving of whole grains per day.	1 2 3 4 5
8. Plan to cook with a healthy oil like olive oil.	1 2 3 4 5
9. Avoid high sugar foods.	1 2 3 4 5
10. Choose olive oil over other types of salad dressings.	1 2 3 4 5
11. Plan to eat nuts, seeds, and legumes every day.	1 2 3 4 5
12. Plan to eat at least 4-5 servings of fruits and vegetables per day.	1 2 3 4 5

1 Certain I Can Not	2	3 Somewhat certain I can	4	5 Certain I can

How certain are you that you can …	How certain? (1-5)
1. Eat at least 5 servings of fruits and vegetables every day?	1 2 3 4 5
2. Eat fruit or vegetables for a snack?	1 2 3 4 5
3. Eat at least 4-6 servings (about 4-6 tsp) of olive oil per day.	1 2 3 4 5
4. Eat 4-6 servings of nuts, seeds, or legumes per week including peanut butter, beans, and peas?	1 2 3 4 5
5. Eat at least 6 servings of whole grain breads, whole wheat pasta, or brown rice per day?	1 2 3 4 5
6. Eat fish, seafood, or chicken 2 or more times per week.	1 2 3 4 5
7. Avoid eating red meat (pork and most beef) more than twice per week.	1 2 3 4 5

Use this scale to tell us if you agree the following will happen:

1 Strongly Disagree ***2*** ***3*** ***4*** ***5 Strongly Agree***

When I eat healthy foods every day, I expect:	Do you agree? (1-5)
1. I will have more energy.	**1 2 3 4 5**
2. I will maintain a healthy weight.	**1 2 3 4 5**
3. My heart health will improve.	**1 2 3 4 5**
4. I will have a higher quality of life.	**1 2 3 4 5**
5. Shopping for healthy foods will be a lot of trouble.	**1 2 3 4 5**
6. I will be bored with what I have to eat.	**1 2 3 4 5**
7. I won't be able to eat the same foods as the rest of my family.	**1 2 3 4 5**
8. I will have to spend too much time keeping track of what I eat.	**1 2 3 4 5**
9. The food I eat will not taste good.	**1 2 3 4 5**
10. It will take too long to prepare meals and snacks.	**1 2 3 4 5**

What is your gender? (please circle one)	Male Female
Which one or more of the following would you say is your race? (please circle one)	White Black Hispanic Asian Pacific Islander American Indian Other
What is your age? (please write a number in)	
What is your annual household income from all sources? (please circle one)	<$15,000 $15,000-25,000 $25,000-35,000 $35,000-50,000 >$50,000
What is the highest grade or year of school you completed?	□ Some High School or Less □ High School Graduate □ Associate's Degree or Technical School □ College Graduate (Bachelors) □ Graduate Degree
What is your marital status?	□ Married/Unmarried Couple □ Divorced/Separated □ Widowed □ Never Married
What is your Zip Code? (please write a number in)	
What is the closest major intersection to your home? (please write in the space provided)	

hillcrest
Medical Center

INSTITUTIONAL REVIEW BOARD

May 10, 2016 **Notice of Exempt Status**

Benjamin Greiner
1420 South Frisco Avenue, Unit #6
Tulsa, Oklahoma 73034

Dear Mr. Greiner:

Under the authority of 45 CFR 46 and the Hillcrest Medical Center Institutional Review Board, a review of the following study was performed on May 10, 2016:

"Food Beliefs Questionnaire"

Primary Reviewer: Diane Heaton, M.D., IRB Chair

The following items were reviewed:

- Exempt Application Form,
- Email, dated May 10, 2016,
- CV, and
- Food Beliefs Questionnaire.

It has been determined that your research project is exempt under 45 CFR 46.101(b)(2) exemption from 45 CFR Part 46 requirements; however, you must also obtain permission to conduct the survey from Wayne Leimbach, M.D. prior to the commencement of this project at Oklahoma Heart Institute.

Any revisions or amendments to the protocol must be submitted for IRB review prior to implementation since those revisions may affect your project's exempt status. You are asked to provide the IRB with a Final Report upon completion of this study.

If you have any questions, I may be contacted at 918-579-1072.

Sincerely,

Dorene Taqi, CIP
IRB Coordinator

Oklahoma Heart Institute

Cardiology
Wayne N. Leimbach, Jr., MD
Robert C. Sonnenschein, MD
Robert E. Lynch, MD
James J. Nemec, MD
Gregory D. Johnsen, MD
Alan M. Kaneshige, MD
Edward T. Martin, MD
Roger D. Des Prez, MD
Raj H. Chandwaney, MD
David A. Sandler, MD
Frank J. Gaffney, MD
Eric G. Auerbach, MD
Robert L. Smith, Jr., MD
Craig S. Cameron, MD
Eugene J. Ichinose, MD
John S. Tulloch, MD
Anthony W. Haney, MD
Douglas A. Davies, MD
Neil Agrawal, MD
Kamran I. Muhammad, MD
Arash A. Kamama, DO
Victor Y. Cheng, MD
Mathew B. Good, DO
Stanley K. Zimmerman, MD
Stephen C. Dobratz, MD
James B. Chapman, MD
Sandra E. Rodriguez, MD
Joseph J. Gard, MD
David A. Liff, MD
Saran D. Oliver, MD

Cardiovascular & Thoracic Surgery
Michael R. Phillips, MD
Edward J. Coleman, MD
John M. Weber, MD

Endocrinology
Christian S. Hanson, DO
D. Erik Aspenson, MD
Cristin M. Bruns, MD
Ralph J. Duda, Jr., MD

Sleep Medicine
Jana R. Loveless, MD
Michael B. Newnam, MD

Chief Executive Officer
Steven M. Struttmann, CPA, CMPE

Oklahoma Heart Institute
at Utica
1265 South Utica Avenue, Suite 300
Tulsa, Oklahoma 74104
918.592.0999
Fax 918.592.1021

Oklahoma Heart Institute
at SouthPointe
9228 South Mingo Road, Suite 200
Tulsa, Oklahoma 74133
918.592.0999
FAX 918.878.2499

Oklahoma Heart Institute Hospital
Campus of Hillcrest Medical Center
1120 South Trenton Ave.
Tulsa, Oklahoma 74104
918.574.9000

May 16, 2016

Hillcrest Medical Center
IRB Committee
Attention: Dorene Taqi
1120 South Utica
Tulsa, OK 74104

Dear Mrs. Taqi & IRB Committee:

Regarding: Research by Benjamin Greiner
On "Food Benefits Questionnaire"

I am writing in regard to the research project of Benjamin Greiner which investigates "Food Benefits" regarding diets.

Mr. Greiner presented his master's thesis project to me and his desire to conduct the project at Oklahoma Heart Institute at the Utica office.

After reviewing his proposal, I have given him permission to conduct his project, which involves patients voluntarily taking surveys about the Mediterranean Diet.

He has already had his project reviewed by the Hillcrest IRB Committee. Should you have any questions, please feel free to contact me at 918-574-9735.

Sincerely,

Wayne N. Leimbach, Jr., MD

College of
Osteopathic Medicine

Office of Research and Sponsored Programs
1111 West 17th Street
Tulsa, Oklahoma 74107-1898
(918) 561-1400
Fax (918) 561-1416

Institutional Review Board
FWA # 00005037

Memo

To: Benjamin Greiner, B.S.

From: Amber Hood, MS, CPIA, CIP Amber Hood
Administrator, Institutional Review Board

Date: May 19, 2016

Re: **Exempt Review Certification of IRB Protocol # 2016014**

Titled: **Dietary Adherence: Social Cognitive Theory and the Mediterranean Diet**

On behalf of the OSU-CHS Institutional Review Board (IRB), I reviewed your protocol entitled *"Dietary Adherence: Social Cognitive Theory and the Mediterranean Diet"* and determined it meets exempted criteria under federal guidelines, 45CFR 46.101(b)(2); therefore, you are free to begin the study.

- ✓ This study involves no collection/use of PHI
- ✓ This study meets the criteria for alteration of informed consent

As principal investigator of this protocol, it is your responsibility to:

- Conduct the research study in a manner consistent with the requirements of the IRB and federal regulations 45 CFR 46.
- Request approval from the IRB prior to implementing any/all modifications as changes could affect the exempt status determination.
- Maintain accurate and complete study records for evaluation by the university, or inspection by regulatory agencies.

When your study is completed, please notify the IRB.

If you have questions please contact me at 918-561-1413 or amber.hood@okstate.edu.

VITA

Benjamin Houston Greiner

Candidate for the Degree of

Master of Public Health

Thesis: DIETARY ADHERENCE: SOCIAL COGNITIVE THEORY AND THE MEDITERRANEAN DIET

Major Field: Public Health

Biographical:

Education:

Completed the requirements for the Master of Public Health in Rural and Underserved Populations at Oklahoma State University, Stillwater, Oklahoma in May, 2017.

Completed the requirements for the Bachelor of Science in your Chemistry – Health Sciences at University of Central Oklahoma, Edmond, OK in 2015.

Experience:

Military
2nd Lieutenant Medical Service Corps Officer at the Oklahoma Army National Guard from August 2016 – present

Emergency Medical Sergeant at the Oklahoma Army National Guard from December 2014 – August 2016

Emergency Medical Specialist at the Oklahoma Army National Guard from August 2010 – December 2014

Academia
Supplemental Instructor, Chemistry, from August 2013 – December 2014

Professional Memberships:

Oklahoma Osteopathic Association
American Medical Student Association