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Lipids, Reactive Oxygen Species, and Health

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Abstract

Cardiovascular disease (CVD) is the leading cause of death in the United States. Coronary artery disease (CAD), where plaque builds up to create atherosclerosis, puts patients at risk for heart attack or stroke. Mitochondrial Reactive Oxygen Species (ROS) have been implicated as a source of oxidative stress that can lead to the development of CAD, and diets high in fat potentiate this occurrence. As certain fats are heated and experience chemical and physical degradation, they cause an increased risk of obesity, diabetes, various forms of cancer, and CVD. This research study, based on CREATION Health ideals, aimed to evaluate the effectiveness of an educational brochure for healthcare providers, in order to promote patient education and participant commitment to improved diet choices. Data from Likert scale respondents (n = 104) and qualitative responses overwhelmingly affirmed the utility of this educational brochure.

Keywords: Cardiovascular disease, cholesterol, coronary artery disease, inflammation, lipids, mono-unsaturated fats, oxidative stress, polyunsaturated fats, reactive oxygen species, saturated fats, and trans-fats

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CHAPTER 1 – INTRODUCTION AND BACKGROUND

Introduction

Cardiovascular disease (CVD) is the leading cause of death in the United States (Murphy, Xu, Kochanek, Curtin, & Arias, 2017). Coronary artery disease, where plaque builds up to create atherosclerosis, puts patients at risk for heart attack or stroke. In the United States, one in four deaths occur due to coronary artery disease – about 610,000 deaths annually (CDC, 2017) and the cost of cardiovascular disease in 2016 was $555 billion (Heart.org, n.d.). Direct and indirect costs of treatment, including medications, surgery, rehabilitation, lost days at work, and lost productivity are projected to dramatically increase with America's aging population (CDC Foundation, 2017; Heidenreich et al., 2013).

A recent study of over 84,000 women identified five separate health risks which have an impact on CVD (Go et al., 2014). Among the risk factors identified were the difference between low consumption and high consumption of trans fats. The risk ratio (RR) for high consumption of trans fat was 57% when compared to just the other four factors in isolation (Go et al., 2014).

Some precipitants of cardiovascular disease include: diabetes, sedentary lifestyle, obesity, alcohol intake, smoking, poor nutrition (CDC, 2017), congenital heart disease and Kawasaki disease (Rad & Assadi, 2014). Other reported risk factors for CVD include: milk consumption (Larsson, Crippa, Orsini, Wolk, & Michaëlsson, 2015), coffee consumption (Liu et al., 2013), methamphetamine use (Darke, Duflou, & Kaye, 2017), and marijuana use (Franz & Frishman, 2016; Thomas, Kloner, & Rezkalla, 2014). Depression and bipolar disorder may predispose patients for CVD (Goldstein et al., 2015; Seldenrijk et al., 2015).

Problem Statement and Purpose

The problems this study addresses are multifaceted. To outline them requires a brief summary of those facets. An effective response to these many problems must take into account these factors to arrive at a true solution.

The Cardiac Problem and Vascular Damage

The vascular endothelial cell lining regulates many important arterial functions such as permeability, tone, angiogenesis, and perhaps most importantly, the response to inflammation. Additionally, other disease processes, such as neurovascular diseases, are also affected by changes in the endothelial lining (Go et al., 2014). The aging process in general and the alteration both in structure and function of the endothelial lining are believed to be the root cause of vascular diseases. These changes occur mainly by cell senescence, oxidative stress, and inflammation and are the key factors that are believed to be the causative precursors to vascular disease.

How This Damage Begins

Some precursors to the inflammatory processes that promote cardiovascular disease are reactive oxygen species (ROS) (Anlar, Bacanli, Kutluk, BaŞAran, & BaŞAran, 2016). While formed in the body in low amounts, and balanced under normal physiologic conditions, ROS can increase due to exogenous and endogenous factors, such as various forms of radiation, exposure to toxic chemicals, co-morbid medical conditions such as diabetes, or merely accumulation over time due to aging (Anlar et al., 2016). This can lead to oxidative stress states that initiate coronary artery disease.

ROS at normal levels are an important signaling mechanism in inflammation. Oxidative distress leads to the weakening of the tight junction between endothelial cells lining the arteries. This is caused by the polymorphonuclear neutrophils (PMNs) through ROS production as a result of inflammation. When the endothelium is weakened, the migration of inflammatory cytokines into the vascular wall results in tissue damage and vascular remodeling (Görlach et al., 2015; Mittal, Siddiqui, Tran, Reddy, & Malik, 2014).

Oxidative damage done to the vessels in coronary artery disease begins in the endothelial lining of the arteries when it is exposed to ROS (Görlach et al., 2015; Mittal et al., 2014; Rajendran et al., 2013). ROS that are produced in the mitochondria are the most important source of damage done in cardiovascular disease (Kalogeris, Bao, & Korthuis, 2014; López-Armada, Riveiro-Naveira, Vaamonde-García, & Valcárcel-Ares, 2013). Many oxidation-reduction reactions take place in the mitochondria and consequently it provides an environment rich in possible sources of oxygen and the formation of ROS (A. Andreyev, Kushnareva, Murphy, & Starkov, 2015).

While the mitochondria also contain mechanisms designed to reduce ROS and can thereby actually reduce ROS levels under normal conditions, this balance can be disrupted when the level of antioxidant compounds lags the influx and production of ROS (A. Andreyev et al., 2015). High fat diets, and their subsequent processing in the liver, play a key role in the further production of ROS (Cardoso, Kakimoto, & Kowaltowski, 2013). With the high fat diet there is a marked increase in the availability of substrates needed to produce a higher mitochondrial membrane potential. This lowers the speed of oxidative phosphorylation reactions and results in

a greater possibility for electron leakage from the usual respiratory electron transport chain into oxidative reactions that directly form ROS (Görlach et al., 2015).

The Role of Diet in the Disease Process

The specific composition of the fats in the diet are another important factor in this process (Guasch-Ferré et al., 2015). As certain types of fat, such as trans-fat, are metabolized, the result is an inflammatory cascade (López-Armada et al., 2013; Monguchi et al., 2017). A high fat diet results in increased production of ROS within the mitochondria (Sverdlov et al., 2015).

The original chemical configuration of fats is not the only factor that plays an important role in the formation of ROS. This configuration is often altered substantially by how hot and how often the fats or oils are heated (Ng, Kamisah, Faizah, & Jaarin, 2012). The fat composition of food can also change dramatically depending on the original recipe, whether it is first fried at the factory, and later when it might be fried again at the final point of sale, and it can even then be altered still further by the fat content of various condiments consumed with it (Moss, 2013). Because of this, the roles of dietary fat, fried foods, and polyunsaturated fats in generating ROS within humans has become increasingly the focus of research.

The Problem of Knowledge Complexity

The problem of ROS and cardiovascular disease as we have seen in so far is that this information is of a highly complex nature. As knowledge of this complex process grows the ability of providers to understand it, let alone explain it to their patients, grows more difficult. Even the very terminology used in the field, such as reactive oxygen species, requires more time to explain it than most providers can devote to in their busy practices.

Yet providers are the most important link in the theory of this study. They collect and synthesize knowledge from many sources. They then formulate it into their patient teaching and are the major link to the synergistic pathway of knowledge being passed on to the community at large.

The purpose of the study is to attempt to bridge this gap between an important body of knowledge and the providers who must pass it on to their patients and family. Of nearly equal importance is the need to impress upon the providers the importance of incorporating this knowledge into their own lifestyles. Information not deemed valuable enough to incorporate into one's own lifestyle is rarely passed on to others with the conviction needed to result in necessary changes in their patients' lives.

The Problem of Knowledge Transfer

Remedies for the damage done by ROS must also be effectively taught to the providers who will in turn pass the information on to their patients. This multistep process increases the number of opportunities for failure and makes effective change more difficult. When presenting important information to a client, particularly when the basic information is of a highly technical nature, transferring that information to the client in a meaningful way is particularly problematic. They may never grasp the intricate technicalities of the information but sensing its importance and being able to synthesize a meaningful response is vital to the information transfer process.

The Problem of Assessing the Success of Knowledge Transfer

Properly assessing the quality of a patient's response is a slightly different problem. When examining a patient's response to education, many mistake adherence for compliance and vice versa. They are not at all synonymous. Compliance has the connotation of submission to a plan of care, and has a certain resistive quality or, at most, passive acceptance and has less

response longevity. In contrast, adherence implies a certain supportive willing characteristic (Meece, 2016).

The therapeutic alliance needed for adherence carries with it a greater chance of success due to the patient ownership of the plan of care (Meece, 2016). Patient education regarding health has been demonstrated to change behaviors in cardiac patients by providing the information, rationale, and motivation they need to form the therapeutic alliance (Ghisi, Abdallah, Grace, Thomas, & Oh, 2014). Assessing and promoting patient motivation and alliance may be the "blockbuster drug of the century" and may include shared decision-making, and identification of challenges and hurdles, in order to engage patients (Dentzer, 2013).

Health care providers have a responsibility to acquire and disseminate evidence-based health information to their patients in order to promote patient autonomy in health care decisions and promote adherence. Often educators are forced to choose between how fast information can be transferred and how well it was understood. The affect that ROS has on CVD is a classic example of a highly complex problem that is difficult to explain rapidly in a way calculated to effect lifestyle changes.

By better patient education and improved adherence to the plan of care, the negative effects of chronic disease and healthcare costs in general can both be reduced (McKenzie, McLaughlin, Clark, & Doi, 2015). By utilizing culturally competent learning aids (Betancourt, Green, Carrillo, & Owusu Ananeh-Firempong, 2016), the healthcare provider can offer health-related material to inform patients and families about disease processes, treatment options, and treatment costs. An effective therapeutic alliance can have many positive effects. By sharing the decision-making process, anxiety can be reduced, cost fluctuations can be minimized, outcomes

can be improved, and the positive feedback will reinforce adherence to the plan of care (Oshima & Emanuel, 2013). These factors are combined in the concept of reciprocity.

The Problem of Making Information Understandable to the Patient

Considering the significant impact nutrition has on health, many healthcare providers have a paucity of training in lifestyle recommendations, such as diet and exercise (Kris-Etherton et al., 2014). The focus of this study is to examine the detrimental effects of an imbalance in ROS. Teaching how this his imbalance can lead to development of coronary artery disease is part of the effective teaching process.

The goal is to provide this education in an easy to understand synopsis in a brochure that is designed to provide maximum concept transfer while minimizing confusing technical jargon. The brochure must convey the importance and be attractive in appearance. There should be enough pictures to keep the interest without oversimplification. As much as possible, it should strike a balance between the needs of the professional educator and the less technical clients they will be teaching.

The aim is to provide an educational tool for providers and their patients that is able to translate evidence into practice and lower risk of disease states in vulnerable populations by promoting nutritional and lifestyle interventions. Most important of all is the need to transfer the information rapidly. Most of the target audience are professionals attending a conference and the contact time available is between meetings. If the time needed for information transfer is too long, the willingness to participate will be less and total participation will suffer. By gauging the response and participation, the quality of information transfer can be better assessed.

Research Question

This study examines the impact of an educational presentation on dietary choices and the eventuality of that information on patient teaching and personal choices. The research question asks: Does a short educational course on the effects of reactive oxygen species, their lipid precursors, and specifically fried foods, enhance healthcare provider knowledge and stated commitment to affect practice decisions and provide patient education of this information? Furthermore, does this information impact stated commitment by healthcare providers to improve their own dietary choices?

The premise for this study is the hypothesis that healthcare provider education affects practice decisions, patient education, and prescribing rationale. Nouri and Rudd (2015) found that patient health education "greatly impacts patient health outcomes." To that end, this study posits that evidence-based information on dietary cardiovascular risk factors can enhance healthcare provider knowledge and, ultimately, enhance patient health literacy and engagement in improved health choices.

Additionally, educational health information may positively impact the healthcare provider's self-intrinsic motivation. This will move the healthcare professional from being a spectator in in their patients' health decisions to leading by modeling healthy decisions (Howe, 2017; Lobelo & de Quevedo, 2016; Wood, 2018). Provision 5.2 of the American Nurses Association Code of Ethics speaks to the utility of personal health responsibility for the nurse: "Nurses should model the same health maintenance and health promotion measures that they teach and research, obtain healthcare when needed, and avoid taking unnecessary risks to their health or safety in the course of their professional and personal activities" (American Nurses Association, 2015).

The material presented in this education topic is especially relevant to healthcare providers and patients living in southern states, given the significant incidence of cardiovascular disease in the following states: West Virginia, Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, and Oklahoma (CDC, n.d.). In addition to regional spikes in cardiovascular disease prevalence, another demographic with a similar increase in disease are the mentally ill (Correll et al., 2017). Patients with mental illness often lack access to educational material on the impact of diet on health. They may lack financial resources to afford a healthy diet or live in food deserts in urban areas with poor access to fresh produce (Walsan, Pai, & Rajan, 2016). Additionally, some psychotropic drugs have known metabolic risks (Curtis et al., 2016).

Concepts and Terms

Reactive oxygen species (ROS) is a term to describe the oxygen-containing molecules, such as nitric oxide (NO), hydrogen peroxide (H_2O_2), hydroxyl radical (·OH−), peroxynitrite (ONOO−), and the superoxide radical $^{\bullet}O^{-}_{2}$, generated endogenously in response to certain external environmental and internal physiologic processes, respectively (Kayama et al., 2015). Also referred to as "free radicals, the majority are characterized by at least one unpaired electron in their outer orbitals" (Görlach et al., 2015). ROS are involved in normal physiologic homeostasis and cellular communication. They work to regulate the immune response and are involved in reproductive steroidogenesis, vascular regulation, and many other physiologic processes.

ROS are involved in inflammatory processes by producing pro-inflammatory mediators that are oxidant-dependent and are active in the upregulation of cytokine, chemokines, and expression of adhesion molecules (Kalogeris et al., 2014). While short term ROS production is a

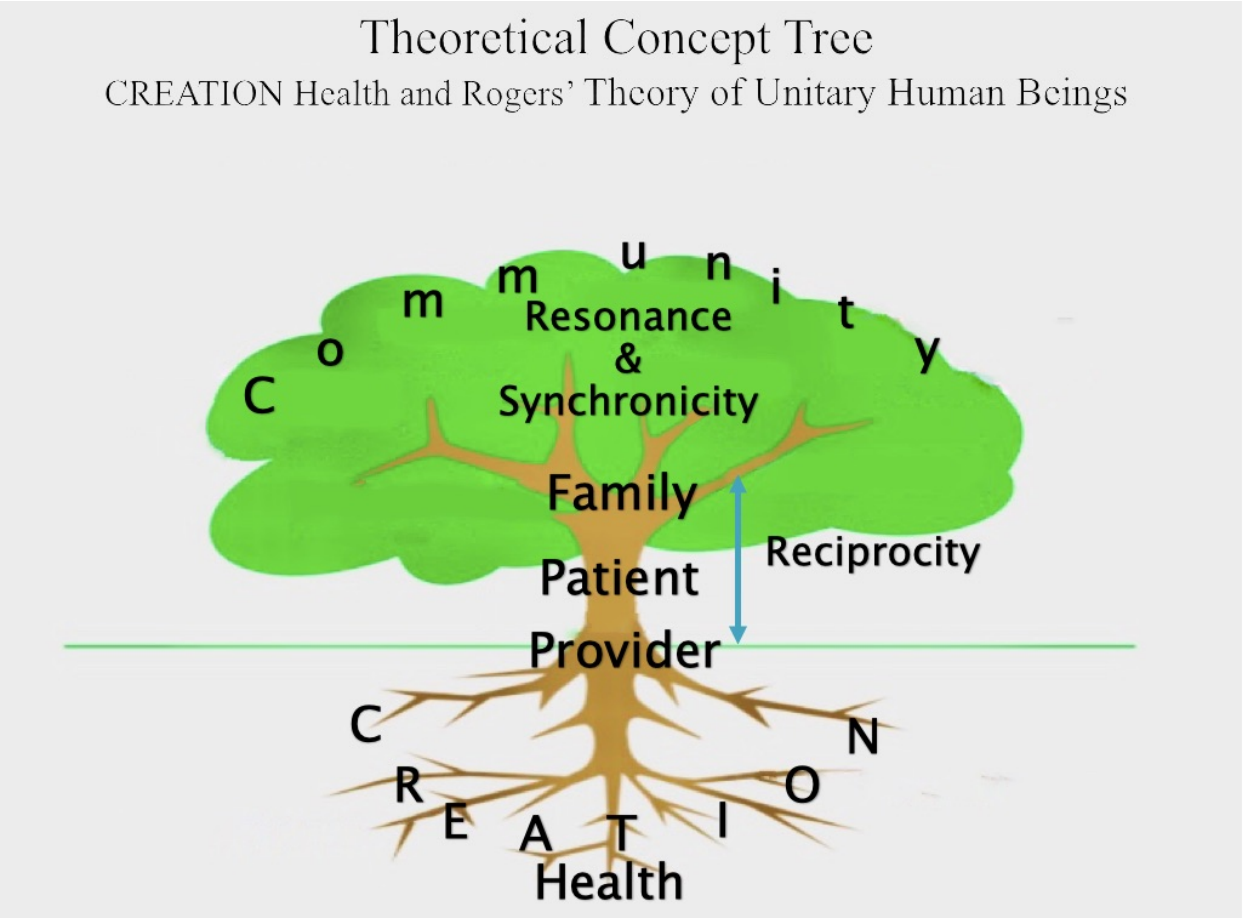
normal process that is cardio-protective, longer term activation, within the mitochondria, has pathological results (Kalogeris et al., 2014). ROS are biologically reactive due to the sensitive and volatile nature of this molecule within a biological organism, as this molecule can stimulate cellular apoptosis or cellular death (Ryan, Faro, Whiteman, & Winyard, 2016).

Inflammation refers to the physiologic and pathologic changes that occur within a biological organism [human] in response to an environmental stressor – such as smoking, poor diet, lack of exercise, pathogen exposure, or radiation. Among these changes are the production of TNF-α and IL-6 upstream, and after liver metabolism, they increase C-reactive protein downstream (Ridker & Lüscher, 2014). These biomarkers indicate the inflammatory process is underway. In fact, C-reactive protein alone is as much a signal of cardiovascular disease risk as either total or HDL-cholesterol (Ridker & Lüscher, 2014). A dysbalance in homeostasis, whereby ROS production accelerates, signals oxidative stress-mediated mechanisms that lead to inflammation (Lushchak, 2014; Mittal et al., 2014). “Low grade inflammation exerts a crucial pathogenic role in hypertension and cardiovascular disease” (Virdis, Dell’Agnello, & Taddei, 2014).

For this study, these above-named processes are involved in the initiation, propagation, and progression of coronary artery disease and the thrombotic complications of atherosclerosis (Libby, 2013). Through a high fat diet, particularly containing polyunsaturated fats, ROS are generated and increase the risk of reactive inflammatory processes (Frankel, 2014). This process leads to coronary artery disease and, ultimately, more acute conditions – such as heart attack or stroke.

Theoretical Framework

The aim of this Scholarly Project is to provide an education brochure that is usable by professionals which will rapidly transfer information to them in a time scale gauged to their availability between conferences. This rapid transfer of complex information will maximize participation without sacrificing the emphasis of importance needed to provide the incentive to incorporate the knowledge into their practice teaching in the reciprocal interchange they will have with their patients. Elements from two theoretical models best support this study and reflect features congruent to each other. Incorporating ideas from classical nursing theory, process theory, implementation theory, and certain nursing models provide insights and guidance by translating research into practice (Nilsen, 2015). Martha Rogers' *Unitary Human Beings* (Gil, 2014; Rogers, 1994), and the CREATION Health model (Creation Health, 2014), both offer components that complement each other in relating to this study.



The CREATION Health model affirms that environment – whether internal or external, can impact health. Consider that internal physiologic, biochemical, emotional, spiritual, and cognitive processes define humans. Those internal processes are largely a reflection of the choices made in interacting in the external environment. Through the senses, in interaction with the environment, the resulting stimuli help in the individual decision-making process. Autonomy of choice is a right, whereby the individual examines options in the environment and selects choices congruent with their knowledge and motivation base. Reciprocity is a multidimensional process where complex information flows from providers to their patients and on through their families into the community at large.

The reception flows back through this bidirectional pathway to the provider who can assess the impact on society indirectly and make their practice changes based on this assessment. It is the quality of the information transfer that sharpens the focus and provides the opportunity for meaningful changes that are evidence based. The research question focuses on the both directions of the reciprocity process by providing important information on health to the target audience and assessing the returning feedback to gauge the quality of both the transmission of information and the incorporation of that information into the recipients plan of action, both for themselves and eventually their patients.

The first step in a patient's self-improvement is to provide them the knowledge to make an informed *choice* (Creation Health, 2014). Choice is a component of the CREATION health model. Empowered choices gain their strength from the confidence of the believer in their ability to improve their well-being (Creation Health, 2014).

Another component of the CREATION model is nutrition. The fuel that the body runs on has an important bearing on sustaining good health. Nutrition has long been known to play an important role in the disease process (Creation Health, 2014).

Some of the principles described in Rogers' *Unitary Human Beings* include the mutual patterns and environmental fields which involve the sharing of knowledge, offering choices, and empowering the patient. Some features of Rogers theory apply as patterns are examined, both direct and indirect, that affect the person and their environment and how that might have an impact on their overall health (Rogers, 1989). The *Unitary Human Beings* model lacks a concrete hypothesis and is not testable, but posits varying themes, such as environment as seen in nutrition, interaction as seen in communication between the provider and the patient, and self-

reflection as seen in patient self-evaluation of their present state of health (Rogers, 1989). This nursing theory is applicable, in that it offers a sense of reciprocity and synchronicity in how humans interact in their environment.

Considering the multitude of dietary practices around the United States and beyond, that may affect health, it is imperative that cultural sensitivity and competence guide nursing practice. Cultural competency and congruency are foundational, and nursing actions should mirror the client's goals. Understanding ways of knowing, patterns, beliefs, and practices will open the door to shared negotiation and accommodation.

These two models overlap in context and design. Rogers' idea of resonancy for the human and environment parallel the CREATION Health model's discovery of how the environment impacts humans in a complementary and dynamic manner. This concept of resonancy can be attributed to the sonority of relatedness from evidence-based health education to healthcare provider and reverberation to the patient. Synchronicity connotes the sharing of ideas, often referred to as "being on the same page." It is the mutual goals of a long, healthy, and productive life which humanity shares that gives vigor to the healing process.

The other features of the CREATION Health model: rest, activity, trust, interpersonal relationships, outlook, and nutrition could also be expounded upon by examining Rogers' model. While not a faith-based model, in the strict sense of the word, or when compared to the CREATION Health model, Rogers' *Unitary Human Beings* model affirms the significance of a spiritual connectedness and wholeness. This sense of wholeness informs the CREATION Health model and imparts the guidance for "healing the full person" (Creation Health, 2014).

Chapter 2 - Literature Review

Literature Review and Synthesis

The effect of diet upon health is an important topic, as Americans seek to reduce healthcare costs and increase quality of life. Lifestyle medicine research focuses on those components of diet, exercise, spirituality, and choice that can enhance quality of life by reducing disease risks. Dietary choices have a substantial effect on overall health, with poor quality diets leading to chronic disease states and early death, and healthy diets preventing these conditions, thus leading to improved length and quality of life (Katz & Meller, 2014).

Educating both patients and healthcare providers about the effect of diet on health is necessary and promotes autonomy. With the CREATION Health model in mind in regards to *choice* and *nutrition,* patients can be empowered to have better options. To that end, this literature review serves to provide healthcare providers with information that will impact practice decisions and influence patients to make healthy choices (Hivert et al., 2016). Databases searched for this study included the following sources: BIOSIS previews, Cochrane, CINAHL, @EBSCOhost, MDConsult, Medline, Ovid, and PubMed. Key search terms included: *cholesterol, coronary artery disease, cardiovascular disease, reactive oxygen species, oxidative stress, trans-fats, lipids, saturated fats, polyunsaturated fats*, and *mono-unsaturated fats*.

History

The past 100 years have seen remarkable changes in the United States. Some of the key events that have shaped this country are involvement in two world wars, increased immigration, the Great Depression, shift from agrarian lifestyle to industrial, technology focus, and advances in transportation, engineering, and medicine. Changes in the demographics of the workforce,

control of wealth, family structure, and health status of Americans are ongoing (Hurst & Rosenfeld, 2015). Americans have witnessed a metamorphosis in society.

Some particular areas of significant change for Americans, over the past century, are in the fields of health and diet. With the shift from an agrarian society to a more urban, industrial, and technologically-based focus, Americans have experienced some health changes related to having a more sedentary lifestyle, and diet changes with the advent of fast food and junk food. The study of food became a science, and researchers sought to reduce food costs through genetic and chemical manipulation of commodities.

Globally, there has been a change to urban living and increased income levels with resulting changes in dietary preferences resulting in more meat consumption and use of refined oil, sugars, and fats. With these changes in lifestyle, chronic, non-communicable diseases have risen. Diseases such as CAD, HTN, and many similar vascular diseases, along with obesity, COPD, and many illnesses involving cognitive decline have all seen an increase.

The common link between them involves oxidative stress caused by in an increase in ROS and results in abnormal function of physiological redox regulation (Fu, Xia, Hwang, Ray, & Yu, 2014). Some of the resulting damage alters cell function, causes protein modification in the cell wall, increases free radical damage, directly alters DNA and gene function and initiates an inflammatory cascade (Ahire, Trivedib, & Pawarc, 2016; Fu et al., 2014). This small sample of the negative effects of elevated ROS provides ample evidence of the role that ROS plays in the development of these diseases (Fu et al., 2014).

When examining the role of fat in the diet, it is important to recognize that not all fat is created equal. The percentage of total fat in the diet is not as important as what kind of fat that it

is (Guasch-Ferré et al., 2015). To understand fully the effect that fat intake has on ROS, some classifications must first be examined.

Trans Fat

One of the most destructive types of fat is known as 'trans-fat'. An important focus of chemical manipulation of commodities was the development of artificial *trans* fats through hydrogenation, a process whereby hydrogen was bubbled through heated vegetable oil creating a semi-solid at room temperature. The resulting product was referred to as "hydrogenated" and contained *trans*-fats, which have all of their hydrogen bonds on opposite sides of the carbon chain. This structure is different than the naturally-occurring *cis* configuration, where the chains of carbon atoms are on the same side of the double bond (Kulig, Pasenkiewicz-Gierula, & Róg, 2016).

As a result of this chemical manipulation of fat, there were two additions to the American diet. Margarine was developed to offer a product that had similar properties to butter but was less expensive, had a longer shelf life, and had longer flavor stability (Andersen & Williams, 2016). The invention of Crisco by Proctor and Gamble in 1911 offered another shelf-stable product that could be produced at low cost (JMK, 2013).

As early as 1910 cholesterol was known to be present in the plaques within the coronary arteries (Zilversmit, 2005). In the 1950s, Americans were cautioned to cut down on dietary fats to prevent heart disease (Gofman et al., 1950; Keys, 1953). The precise mechanism of how atherosclerosis progressed was not fully understood in the early days, but the correlation between the known makeup of plaque lesions and dietary fat intake resulted in the precautionary instructions being issued. In 1990, Mensink & Katan found that dietary *trans*-fat consumption

adversely affected cardiovascular health by increasing higher serum triglyceride levels, promoted hypercholesterolemia, and created an imbalance in the LDL to HDL ratio (Mensink & Katan, 1990). The Food and Drug Administration (FDA) ruled in 2015 that *trans*-fat must be eliminated from food products such as

- Baked goods (cookies, cakes, pies, and crackers)
- Ready-to-use frostings
- Snack food (such as potato chips and microwave popcorn)
- Fried food typically found in fast food restaurants (such as French fries, fried chicken, and doughnuts)
- Refrigerated dough products (such as biscuits, cinnamon rolls, and frozen pizza)
- Vegetable shortening
- Stick margarine
- Coffee creamer (FDA, n.d.).

Polyunsaturated Fats in the Diet

In examining American's dietary preferences, fried foods are popular (Djoussé, Petrone, & Gaziano, 2015). French fries, potato chips, onion rings, donuts, fried vegetables and meats, and certain Asian foods that are deep-fried are all consumed in increasing amounts. Fried food consumption has been linked to increasing rates heart disease and obesity, particular in regions where fried foods are an important part of the local cuisine (CDC, n.d.; Djoussé et al., 2015).

With Americans' growing health awareness, a shift was made from *trans*-fat, or hydrogenated fat use to polyunsaturated fats or "PUFAs" found in vegetable oils and are liquid at room temperatures. This change was perceived as being more healthful than using *trans* fats (Keys, 1970). The American Heart Association recommends the moderate use of

polyunsaturated fats, such as soybean, corn, canola, or sunflower oil, or monounsaturated fats, such as that from nuts, olives, or avocados, over saturated fats to reduce risk of heart attack and stroke (American Heart Asssociation, n.d.).

The problem with PUFAs is that they are not as shelf-stable as the *trans* fats are and are especially prone to oxidative degradation through auto-oxidation and photo-oxidation. The presence of oxygen is the determining factor in this quality loss (Johnson & Decker, 2015). Heat has been found to accelerate lipid oxidation (Roman, Heyd, Broyart, Castillo, & Maillard, 2013) as well as high pressure processing (Medina-Meza, Barnaba, & Barbosa-Cánovas, 2014).

When fats are heated in the presence of oxygen, several different chemical and physical changes take place. Some molecules merely change the formation of the atoms they contain, a process known as isomerization. Others link with their neighbors forming longer chains, known as polymerization, while still others combine with the oxygen and oxidize. The result of these changes is a depletion of natural antioxidants, such as Vitamin E, and an increase in compounds that, when metabolized in the body, prove detrimental to the endothelial lining of the cardiovascular system (Dobarganes & Márquez-Ruiz, 2015; Falade, Oboh, & Okoh, 2017; Ng et al., 2014).

A closer look at how the subcellular processes react to these factors is even more complex. As early as 2005 or earlier it was believed that mitochondria could be an important sink for ROS and this remains the belief today (A. Andreyev et al., 2015; A. Y. Andreyev, Kushnareva, & Starkov, 2005). However, this important function of the mitochondria can easily be turned into a production factory for highly damaging levels of ROS when triggered by dietary factors. This pathological ROS production is further exacerbated by a decrease in natural

antioxidants in the diet (Görlach et al., 2015). The tools needed to study these phenomena are still in development (A. Andreyev et al., 2015).

Fried Food

Thermal oxidation is of particular concern for foods that may be fried, as heating and reheating of oil used for frying, can cause development of *trans* fatty acids in direct proportion to the temperature and length of time oil is heated. Continuous consumption of oxidized oils has been linked to hypertension (Jaarin, Masbah, & Nordin, 2016) and hypercholesterolemia (Ganesan, Sukalingam, & Xu, 2018). The resulting inflammation of the vascular lining and other vascular changes, such as vascular dilation, vascular leakage, and vascular remodeling, that result from this increases atherosclerotic risk (Ng et al., 2014). Consumption of fried food has been associated with an increased risk ratio (RR) of diabetes by over 1.50, depending on the frequency of consumption (Cahill et al., 2014). Similar increases in risk are seen with hypertension which yields a similar RR of up to 1.45 (Carmen Sayon-Orea et al., 2014), obesity showed an even higher RR of up to 1.73 (C Sayon-Orea et al., 2013). The RR varies with cancer depending on the site location, but lung, colorectal, breast, and prostate cancer all show a substantially higher RR with some locations such as breast cancer sharply elevated at 1.92 (Ganesan, Sukalingam, & Xu, 2017; Stott-Miller, Neuhouser, & Stanford, 2013), and gestational diabetes showed an RR of up to 1.93 (Bao, Tobias, Olsen, & Zhang, 2014).

How the body was designed to cope with an onslaught of oxidative reactions is important to consider. During the frying process, natural vegetable source antioxidants are destroyed due to the prolonged high temperatures of the fryer oil (Falade et al., 2017). Commercial establishments and factories add chemical antioxidants to fryer oil. These synthetic antioxidants include butylated hydroxytoluene (BHT), tertiary butylhydroquinone (TBQH), and butylated

hydroxyanisole (BHA) (Aladedunye, 2014). These synthetic antioxidants allow more prolonged fryer oil use and reduction of undesirable flavors. Antioxidants serve to neutralize oxidative reactions and prevent damage to the body. Antioxidants are provided in abundance by natural fruits (Manganaris, Goulas, Vicente, & Terry, 2014), vegetables (Lima, Vianello, Corrêa, Campos, & Borguini, 2014), nuts, herbs, spices (Embuscado, 2015), chocolate, green tea (Zujko & Witkowska, 2014), and breast milk (Ma et al., 2017). In contrast however, meat sources are low in antioxidants. In fact, meat sources for antioxidants are nearly negligible compared to produce (Carlsen et al., 2010). Important safeguards against the accumulation of ROS include many compounds such as vitamin C and other similar antioxidants (Rajendran et al., 2014).

Commercial fryer oil is usually heated to 375 degrees Fahrenheit, and vegetable oils have varying smokes points below this. Heating oils to this temperature causes development of toxic aldehydes, as a result of fatty acid degradation and this is an added health risk in its own right. After the first use, oil is often reheated and starts the process of chemical alteration over again. Each time oil is reheated, the smoke point and antioxidant content is reduced, and volatile compounds and polymers are produced (Falade et al., 2017). Duration of use of fryer oil depends on several factors such as method of frying; i.e. pan frying vs. deep frying, frequency of use, type of oil, temperature, and type of food fried (Gadiraju, Patel, Gaziano, & Djoussé, 2015; Kamisah, Ang, Othman, Nurul-Iman, & Qodriyah, 2016).

High Fat Dietary Practices and Health

Correlation can be drawn from dietary practices, fried foods, oxidative vascular damage, and heart disease (Ng et al., 2014). Sampson (et al., 2013) found the odds of both unreported and uncontrolled hypertension were twice as high among blacks (OR, 2.13; 95% CI, 1.68–2.69; and OR, 1.99; 95% CI, 1.59–2.48, respectively), as among whites (Sampson et al., 2013). Fried

food consumption is much higher in Non-Hispanic African-Americans than in Hispanics or Non-Hispanic Whites ($p<0.05$) (Emerson, Towns, Jones, Cain, & Hull, 2015). Furthermore, obesity rates for children are increasing (Skinner, Perrin, & Skelton, 2016). Lifestyles which include high fat consumption, increased use of tobacco, lack of access to healthcare, poverty, and lack of education all contribute to chronic diseases (Akinyemiju et al., 2016). Unfortunately, these practices are spreading across the United States, and chronic diseases are becoming pandemic.

Health Effects of Reactive Oxygen Species (ROS)

ROS have strong oxidative properties and normally act as beneficial signaling mechanisms in the body. Signaling mechanisms affect many cellular events governed by macromolecules, such as proteins and fats, which include adhesion and migration, the contractility of membranes, hypertrophy and cellular proliferation, the formation of new blood vessels, cell life span and auto-destruction, and even gene expression (Brown & Griendling, 2015; Kayama et al., 2015). When there is an imbalance in the system, and antioxidant activity is inadequate to neutralize ROS, their action causes deleterious effects in the system with oxidation of protein, damage to DNA, and oxidation of lipid cellular components.

Considerable interest has been generated in the field of food science technology regarding the peroxidation of polyunsaturated lipids (PUFA) and their role in cellular and membrane damage (Sies, 2013). By the generation of reactive oxygen species through oxidative reactions such as peroxidation of PUFAs, certain key physiologic and pathophysiologic processes are initiated that can lead to inflammation, carcinogenesis, ageing, and adverse drug effects on the body. Normal ROS levels are held in check by several naturally occurring antioxidants, such as Vitamin C, superoxide dismutase (SOD), and catalase or glutathione peroxidase (GSHPx). However, when the diet is flooded with ROS, the buffering of the natural

enzymes and antioxidants is exceeded, shifting the body to an oxidative state leading to initiation of pro-inflammatory processes and the development of chronic disease states (Kayama et al., 2015; Poljsak, Šuput, & Milisav, 2013).

Consumption of fried foods can lead to development of ROS. The chemical byproducts generated during frying food initiates production of free radicals. Repeatedly heated cooking oil (RHCO) physically and chemically alters it, increasing the free radical content substantially (Venkata & Subramanyam, 2016). The result is a wide range of predictable negative health consequences that range from endothelial dysfunction to hypertension and cardiovascular disease (Venkata & Subramanyam, 2016). The oxidizing effect of repeated heating in RHCO is directly related to how often it is heated. Unless the taste becomes objectionable, the economic pressures will extend the number of heating cycles as long as possible. This has disastrous consequences on the poor who are the main consumers of these fried foods both in this country and in poorer countries around the world (Kakde, Bhopal, Bhardwaj, & Misra, 2017; Kirkpatrick et al., 2013; Tach & Amorim, 2015; Venkata & Subramanyam, 2016). These detrimental health effects include high blood pressure, increased cholesterol, and inflammation of the vasculature and vascular changes leading to atherosclerosis.

Under normal physiologic conditions, the mitochondrial function of the vasculature system act to produce ROS and regulate the antioxidants in a finely-tuned process. These ROS act as key signal messengers to aid in balancing physiologic properties of vascular smooth muscle cells and management of cellular transport mechanisms such as proteins and Na+ and Ca+ across membranes.

Pathological mitochondrial function is a disruption of this normal function and involves the mitochondrial permeability transition pore (mPTP). When the mPTP is stimulated by ROS, the result is further release of ROS in a phenomenon known as ROS-induced ROS release (RIRR). This RIRR release of ROS can result in an abnormal and highly amplified ROS signal which can affect far more than the mitochondria. The resulting feedback to neighboring mitochondria can cause an avalanche of ROS that results in mitochondrial injury and even cellular death (Zorov, Juhaszova, & Sollott, 2014).

Another function is that of vascular endothelial cell proliferation and migration. When there is an overload or imbalance of ROS in the system, the vasculature exhibits an alteration in antioxidant capacity with resulting system inflammation. This may lead to dysregulation of systolic and diastolic function and cardiac arrhythmias. Other reported cardiopathies include coronary artery disease and complications due to diabetes (Köhler, Sag, & Maier, 2014; Mackenzie et al., 2013; Vara & Pula, 2014).

The mechanism behind this pathology has to do with how the vascular lining is maintained. Endothelial progenitor cells (EPC) are formed in the bone marrow and migrate to sites of endothelial injury and dysfunction and result in atherogenesis at the target site. This is dependent upon the expression of adhesion molecules which are produced at the target site on the endothelial surface. These adhesion molecules are stimulated in part by inflammatory cytokines that are produced at these sites, such as tumor necrosis factor-α (TNF-α), interleukin-1β, stromal derived factor-1, and granulocyte macrophage-colony stimulating factor. When the EPC arrive in sufficient numbers, repair of damage and needed new construction takes place in an orderly fashion, but overstimulation by ROS results in a drop in EPC. While the normal low

levels of ROS promote an increase in EPC, high level have the opposite effect. As EPC levels decline, cardiovascular disease is the result (Lin et al., 2013).

As humans age and tissue breaks down, ROS production increases and endogenous antioxidant function slows down. Endogenous factors for oxidative stress include inflammation, elevation in O2 concentration, and increased mitochondrial leakage, and exogenous factors promoting oxidative stress include environmental pollution, strenuous exercise, tobacco use, diet, chronic inflammation, and psychological distress (Poljsak et al., 2013). There nine hallmarks of mammalian aging: "genomic instability, telomere attrition, epigenetic alterations, loss of proteostasis, deregulated nutrient sensing, mitochondrial dysfunction, cellular senescence, stem cell exhaustion, and altered intercellular communication" (López-Otín, Blasco, Partridge, Serrano, & Kroemer, 2013).

With the aging process, these factors and ROS impact on DNA stability, mitochondrial deterioration, and unbounded cellular damage. These effects can lead to three salient age-related neurological disorders that have been linked to an overabundance of ROS. These disorders include Parkinson's (PD), Alzheimer's (AD), and schizophrenia (Campos, Paulsen, & Rehen, 2014). These processes come full-circle, when considering that obesity and a high-fat diet are implicated in mental decline in the elderly (Knight, Martins, Gümüsgöz, Allan, & Lawrence, 2014). Consumption of fried foods has also been implicated as one risk factor for accelerated cognitive decline at older age (Ozawa, Shipley, Kivimaki, Singh-Manoux, & Brunner, 2017).

Conclusion

With America's rising chronic disease outlook, and the significant effect of environment and diet on health, examination of controllable health factors is key (Zarrinpar, Chaix, & Panda, 2016). The impact of a high-fat diet, fried foods, and the effects of ROS lead to vascular and

system dysregulation, with promotion of diabetes, cancer, and cardiopathies. The aging process accelerates through an imbalance in ROS action leading to senescence of cellular function and alterations in genomic stability. Researchers agree that dietary choices play a leading role in determination of health or disease manifestation.

Chapter 3 – Project Description

Objectives and Design

This study examined the impact of a teaching intervention on nurse practitioners' commitment and interest in professional interaction with patients and discussions about the role of lipids, fat composition, and ROS in the diet and their effect in coronary artery disease. This teaching material was presented at three venues using a quantitative descriptive study design. Teaching was provided in the form of a full-color brochure with text and graphics followed by evaluation with a Likert scale. This material will assist in future practice decisions and patient education, to reduce health risks.

Procedure

Description of Procedure

The educational brochure and corresponding Likert scale tools were made available to select venues where providers would be present. Each site required permission from the respective venue hosts. The teaching brochure and the response tool were made available to all who chose to participate, and they were given a chance to review the information. The tools were collected after they responded and completed the survey. No personal identifying information was collected. The collected responses where entered into an excel database and each response tool was given a unique identification number. Entries where double checked for accuracy after entry and further processing was performed to obtain statistical information on the responses received.

At the Tennessee Nurse Practitioner meeting, a small sign was posted on the front of the table with the name of the brochure. When attendees approached the table, an introduction was made, and the purpose of the project was explained. Attendees were handed the brochure and

asked to responded to the Likert scale questions following review of the brochure. Most sat down in adjacent chairs in the lobby and read it on the spot. The time frame was the break between conference sessions which varied somewhat. Some took the brochure and promised to return the Likert tool later, but few who did so actually returned the response tool.

Although the Likert scale did not ask for any personal identifying information, participants were reminded to avoid including any personal identifying data. At no time during the conference was assistance given in filling out a Likert scale, and no was assistance requested. After filling out the Likert scale, participants were asked to place the document face-down on the table. These Likert scale documents were removed and secured in a manila envelope for later review. No person, other than the principal investigator, had access to these Likert scale documents.

With the CANAP monthly meeting held Tuesday, June 19, 2018, the teaching brochures and Likert scales were distributed to the attendees' tables prior to the meeting commencement. The president of CANAP announced the purpose of the distributed brochures during their usual monthly meeting and invited all who chose to respond to take part in the project. Attendees who chose to participate were then directed to return the Likert scaled response tools to the principal researcher at the conclusion of the meeting. All responders filled out the response tool during the session, which lasted approximately two hours, and returned it as the meeting was ending. Similar privacy of data was maintained as at the previous venue.

With the final venue at Southern Adventist University, the teaching brochures and Likert scales were distributed prior to class time in two classes, with professor approval. Students were informed that the purpose of the informational brochure and the response tool were for the fulfillment of a doctoral research project. Those students who chose to participate returned these

to the professor at a later date who then forwarded them to the principal researcher. Similar privacy of data was maintained as at the previous venues.

Resources

The project provided an educational booklet to current practicing nurse practitioners in Tennessee as well as MSN-enrolled nurse practitioner students at Southern Adventist University. The respondents reviewed the material and responded to it by filling out a response form. The goal was to obtain a minimum of 100 total subjects for participation.

Using a flash drive, the file for the educational booklet and Likert scale was provided to Staples in Cleveland, TN for printing. The eight-page booklet was printed in color on glossy paper, and the Likert scale was printed in black and white. The number of each printed was 130. See Appendix C for budget for project.

The resources needed were a sufficient supply of brochures to accommodate the most optimistic number of willing participants along with a sufficient supply of response tools to record their reaction. Other supplies involve were the usual travel necessities and hotel accommodations to enable attendance at the conference. Permission to present was obtained from the seminar officials in advance.

The personnel was limited to the principal researcher, who communicated directly with organizational bodies (CANAP, Tennessee Association of Nurse Practitioners, and Master's level nursing students at Southern Adventist University). The principal researcher singularly designed this study, gained IRB approval, implemented the planned study, financed all costs associated with printing, travel, lodging, computer costs, membership fees, etc., and processed all data collected from the study. The principal researcher likewise prepared and presented the final results with a Power Point presentation to nursing faculty at Southern Adventist University.

Technology needed were computer use for email, project write-up, and statistical summary. Computer technology included use of Microsoft Word, Excel, and PowerPoint. The cell phone was used to communicate with some of the organizational bodies as well as to take photos as some of the venues. The budget details for this project are outlined in appendix B.

Timeline of Project Phases

The timeline is described below:

1. Spring 2018: Continue research on project and present 15-minute proposal Power Point at Southern Adventist University in spring of 2018.
2. Spring 2018 – Submit written proposal and request for IRB to Southern Adventist University.
3. Spring & Summer of 2018 – The first research site was the annual Tennessee Nurse Practitioners Association Conference March 27-30 at the Omni Hotel in Nashville, TN. The second site chosen was the Chattanooga Area Nurse Practitioners Association ("CANAP") at a monthly meeting dated Tuesday, June 19, 2018. The final research site involved Masters-level nurse practitioner students at Southern Adventist University who were seen before or after class time on June 12, 2018, with express permission of nursing faculty (Dr. Liedke) for the assigned classes.
4. Summer of 2018 – gather responses from post survey and write up findings
5. Fall 2018 – Completed project presentation at Southern Adventist University School of Nursing.

Resource personnel involved involve faculty advisors at Southern to help guide this project. Technology was computer-based with Power Point presentation. Budget details are described in Appendix B.

Instruments and Measures

A Likert scale (Appendix A) with 20 items was developed and approved in cooperation with faculty at SAU. The tool was designed to rapidly assess the impact of a brochure used to train professionals in the important health risks of ROS. An acknowledged limitation in design was the extremely limited time frame which provided access to the target audience most of whom were seen in between conference sessions. This also limited the ability to test the instrument itself. The instrument used five possible response categories.

The Likert scale questions focused on three main components. The first component was the response to the brochure as expressed in questions one through five. The second component evaluated their commitment to share the material with others as was seen in questions six through nine. And the third component was a self-assessment of their own lifestyle in an effort to provide the introspection needed to place a higher value on the material presented. This was accomplished with the last half of the questions.

The participant response to the educational brochure is an important factor in the reciprocity process. A poor response virtually guarantees no further transmission of information. The participant's commitment to share the material with others is a key indicator of how likely it will be passed on. And finally, and perhaps most importantly, the estimation of the material's value is an important indicator on whether was deemed valuable enough for the participant to commit to incorporating the material into more than their teaching, but even to their own personal health improvement. Percentages from each Likert scale response was evaluated for these three components. The nurse practitioners who read this booklet were asked to respond to a survey with a Likert scale about the effectiveness of the teaching provided. The results were tallied and are reported in Appendix C.

Target Population and Setting

Subject Recruitment

The first location in March was the third annual Tennessee Nurse Practitioners Association (TNNPA) Statewide Conference - Omni Hotel, Nashville, TN, March 27-30, 2018. At this venue, a table was provided by organization and placed in a visible location opposite the main registration table in the vendor area for access by conference participants. Approximately 150 attendees annually participate in this conference, so it was expected that there would be a robust sampling to participate in the survey. Recruitment involved inviting passing attendees to stop, receive the information and brochure, and answer the survey questions.

The second locale chosen was the Chattanooga Area Nurse Practitioners Association ("CANAP") were surveyed at a CANAP area meeting Tuesday, June 19, 2018. At this smaller venue, the brochures and Likert scales were distributed to the participant tables with an invitation to return them to the principal researcher. There are over 50 members in this organization and the number of attendees are variable.

At the final locale, Masters-level nurse practitioner students at Southern Adventist University were seen before or after class time. There were approximately 30 students in these combined two classes. Participation was voluntary at all three venues.

Inclusion and Exclusion Criteria

In order to obtain an unbiased sampling, both nurse practitioner students and currently practicing nurse practitioners in Tennessee were sampled. While not a specified group selected for inclusion in this study, a few physicians opted to participate. Exclusion criteria include: minors and anyone not currently involved in healthcare i.e. lay public.

Ethical Considerations

In accordance with the guidelines regarding human research subjects established by the Belmont report, the overarching principles of (1) respect for persons, (2) beneficence, and (3) justice were maintained (Miracle, 2016) Furthermore, ethical elements of informed consent, understanding, voluntary participation, disclosure, confidentiality, and competence were enforced. In addition, there was a lack of exculpatory language - whereby the research subject waives their legal rights (Miracle, 2016).

The Belmont Report was published in 1979 by the U.S. Department of Health and Human Services and serves to guide research with human subjects in biomedical and behavioral health fields. This treatise on research is the foundation of the American Nurses Association ("ANA") code of ethics. While the ANA code of ethics does not have the exact wording as the Belmont Report, concordance of intent can be drawn from each. The following few samples from the ANA code of ethics offers an expanded interpretation of the Belmont Report:

Provision I: respect for human dignity

Provision I: the right to self-determination

Provision II: primacy of the patient's interests

Provision III: protection of human participants in research – respect for autonomy, respect for persons, respect for self-determination (American Nurses Association, 2015).

Benefits of Participation

The primary benefit to the participants is that of increased knowledge of health risk factors related to lipid consumption. Research subjects have an opportunity to pass on the knowledge gained to their patients and potentially reduce risk of cardiovascular disease in the community. Another benefit is value to society by gain in the body of scientific knowledge.

Finally, subjects have an opportunity to learn about the CREATION health program and its impact on overall health.

Risks of Participation

The risks to subjects participating in this study may include: lack of privacy in discussing the study between participants at the same venue, but not by the principal researcher. Another risk is lack of health material literacy due to lack of familiarity with chemistry concepts mentioned in the educational topic. Another risk is lack of understanding of specific cardiovascular risk information due to professional practice role focused in another area that may not encounter cardiovascular disease. There is a risk to study participants, that they may experience feelings of cognitive discord/discomfort in learning the material and comparing the information to their own [unhealthy] dietary practices. There is a risk that study participants may experience cognitive dissonance, as they reevaluate their priorities related to preventive patient teaching and health risk reduction (Ubel & Asch, 2015). Since no biological specimens will be collected, and administration of foreign materials into the body will not be performed, there are no risks in these regards. In weighing the risk/benefit ratio, it appears that the benefits of this study outweigh the risks.

IRB approval

After being signed off on by the faculty advisor, Dr. Michael Liedke, for this project, the study then was submitted for IRB approval through Southern Adventist University. Approval for form A was granted on March 15, 2018. An updated IRB was submitted with form B to reflect additions made with the CANAP monthly meeting. This second IRB proposal was approved on May 29, 2018.

Protection of Human Subjects

Human subjects were protected, as no personal identifying information, such as name, birthdate, or personal contact information, were gathered. No invasive collection of human body fluids or tissue were conducted. The survey was voluntary, and participants were able to refuse to do the survey or opt out at any time.

To proceed with this project, approval from Southern Adventist University's Institutional Review Board (IRB) was obtained. No human subjects experienced any medically invasive procedures in this study. No physical pain was inflicted due to participation in this study, and no personal identifying data was collected.

This project maintained protection of privacy. Any gathered responses to the educational presentation did not contain any participant identifying information and were anonymous. Participants reserved the right to exit the survey at any time.

No remuneration or any other incentives or prizes were offered for participation. This research study and survey were conducted at no cost to any participants. The results of the survey were kept in a locked and secured location, and the surveys will only be reviewed by this author or any nursing professor at Southern Adventist University who may request access. At the conclusion of the study, all of the Likert forms will be destroyed.

Mutual Agreement with Cooperating Agency

Email contact was made with Dr. Irene Bean, DNP, FNP-BC, FAANP, president of the Tennessee Nurse Practitioners Association. She authorized the project to be presented at the annual meeting for Tennessee Nurse Practitioner Association in Nashville, March 27-30, 2018. Email contact was made with Jateum Blackburn, president of CANAP, and she authorized the project to be presented at the July 19, 2018 CANAP meeting. Dr. Michael Liedke authorized

distribution of the educational brochure and Likert scale following class time for Masters level nursing students on June 12, 2018.

Evaluation Plan

A Likert scale assessment tool was provided following patient review of the educational brochure. (see Appendix A). Raw data from the questionnaire was hand entered into both a Microsoft Excel spreadsheet and each line was verified and cross checked twice and matched to the corresponding identification code placed on individual forms to each individual form to ensure error free entry. The efficacy of the teaching material to answer the research questions was then assessed using statistical analysis of the results after it was exported into the freeware software package GNU PSPP version 1.01 by GNU software. This software emulates IBM's SPSS statistical software package, a statistical software package that is frequently used in academic research.

The planned descriptive statistics were mean and standard deviation. An inter-item correlation matrix and reliability statistics such as Cronbach's Alpha based on standardized items were also included. The results of some of the data processing can be found in Appendix D. Based on the review of that analysis an assessment of how that output reflects on the research questions was evaluated.

Summary

A brochure with printed and graphic information and survey were provided to selected nurse practitioners in Tennessee. Using the CREATION Health model as the theoretical framework this material offered information about lipids, reactive oxygen species and health. Specifically, this information was provided to enhance provider knowledge to make positive practice decisions and aid patients in reducing cardiovascular risk factors. This study

commenced in the spring and summer of 2018. Nurse practitioners at Southern Adventist University, CANAP, and TNNPA had an opportunity to read and evaluate the educational material with a Likert scale. The Likert scale responses were tallied and reported.

Chapter 4 – Analysis of Results

Data

From an original printing of 250 surveys and brochures, and 188 actually distributed, not all surveys were returned. At the Nashville TNNPA meeting in March, there were 67 respondents. For the CANAP meeting, there were 23 respondents, and there were 14 respondents at Southern Adventist University. The responses from all three venues were combined. In total there were 104 respondents. The data related to provider role and years of experience are shown below in tables I and II, respectively.

Table I - Respondent Demographics

Count	Provider role
3	Acute Care Nurse Practitioner (ACNP)
1	Adult Gerontology Primary Care Nurse Practitioner (AGPCNP)
2	Adult Nurse Practitioner (ANP)
7	Blank
2	Doctor of Osteopathy (DO)
58	Family Nurse Practitioner (FNP)
6	Medical Doctor (MD)
6	Registered Nurse (RN)
18	Student
1	Women's Health Nurse Practitioner (WHNP)
104	Total Respondents

Table II - Years of Experience

Professional Role	Minimum# years	Maximum # years	Average # years
ACNP	6	10	8.33
AGPCNP	3	3	3.00
ANP	12	30	21.00
DO	2	25	13.50
FNP	<1	25	7.53
MD	4	44	22.67
WHNP	9	9	9.00

Participants were asked to respond to the teaching brochure with a one to five Likert scale rating, with one portrayed as strongly disagree, two as disagree, three as neutral, four as agree, and five as strongly agree. The Likert scale responses one to three were assigned as low ratings, and four and five were assigned as high ratings. Survey questions one through four were related to the respondents' assessment of the quality of material presented in the teaching brochure. Questions five through nine estimated whether the teaching material was applicable for their respective practice. Respondents were assessed regarding the utility of this information for patient teaching about health risks. Survey questions 10 through 20 related to the respondent's own personal commitment for positive lifestyle change using the CREATION Health framework.

Reliability

The survey was divided into three sections for assessment of the reliability of the tool. The first four questions examined the participant's evaluation of the importance of the material

presented in the brochure and had a high Cronbach's alpha score of 0.83. This indicates a high correlation between items in this section, demonstrating similarity in the construct.

The next section was questions six to nine and entailed the likelihood of sharing the information with patients. The Cronbach's alpha for this section was 0.78. This Cronbach's alpha was also very good, effectively with high inter-item correlations between items related to sharing information.

Questions 10-19 assessed personal health habits. The Cronbach's alpha for this section was 0.804. The Cronbach's alpha is good and indicates a high relatedness in the questions of this section related to personal health habits and CREATION health.

Descriptive findings

Means and standard deviation scores for each question were calculated. In Table III, respondent Likert data is shown indicating percentages, based on 104 responses, assigned according to RN/student status or professional (nurse practitioner or physician) status. The data notably shows that not all respondents answered all fields, thereby the rows do not necessarily add up to 100% of the total 104 participants. No participants responded more than once in the given row.

Table III - Respondent Percentages

Question# on survey	RN/Student (#17) answered 1-3	RN/Student (#17) answered 4-5	Professional (#87) answered 1-3	Professional (#87) answered 4-5
1	0	100%	1%	97%
2	0	100%	5%	93%
3	17%	83%	15%	84%
4	8%	92%	15%	84%
5	0	100%	7%	92%
6	8%	92%	10%	89%
7	33%	67%	16%	82%
8	67%	29%	53%	45%
9	25%	75%	23%	75%
10	13%	79%	23%	75%
11	4%	88%	11%	79%
12	13%	88%	3%	96%
13	67%	33%	41%	58%
14	79%	21%	66%	34%
15	71%	29%	58%	41%
16	17%	83%	14%	85%
17	13%	88%	8%	90%
18	0	100%	8%	90%
19	50%	50%	32%	67%
20	21%	79%	21%	73%

While most of the responses (n = 14) indicated favorable (4-5 on Likert scale) for both RN/student and professionals, there were five data anomalies.

Question #8 “Patients that I see are interested in learning more about preventive medicine, including healthy eating”. For this question, both RN/student (67% answered 1-3) and professionals (53% answered 1-3) indicated that they believe their patients are not interested in learning about preventive medicine or healthy eating.

Question #13 “I have a stress-free *environment* that enhances my well-being.” RN/student respondents (67% answered 1-3), indicating that they do have a stressful environment. Professionals, alternately (41% answered 1-3) do have a more stress-free environment.

Question #14 “I exercise regularly and lead an *active* lifestyle.” Both the RN/student (79% answered 1-3) and professionals (66% answered 1-3) indicated that they do not exercise regularly.

Question #15 “I find that *trust* and a faith/spiritual perspective enhances my quality of life.” Neither the RN/student group (71% answered 1-3) or the professional group (58% answered 1-3) report a faith-based perspective.

Question #20 “The websites about healthy recipes and overall health practices are a benefit to me, my family, or my patients.” The RN/student group was equally divided (50% to 50%) about the website utility. The professionals, however, found the websites to be of value (67% answered 4-5).

Qualitative Responses

Survey participants offered written and verbal responses to the educational brochure. One physician provided feedback on overall design and format to improve style. His remarks

aided in improving the final product. After reading the brochure, another physician remarked that he needed to change the way he ate and has started attending vegetarian cooking classes. Another participant physician asked for additional copies of the brochure to hand out to patients. One student has become vegan since the study began.

Written and verbal feedback was mostly positive and supportive with the following remarks shared: “Great job!”; “This information should be promoted more.”; “I know I need to change the way I eat, and this is helpful information.” Several respondents remarked positively on the graphics, readability, and layout of the brochure.

Some written and verbal responses indicated that the material was not useful to the respective provider’s patient population. For example, providers with the role of nurse practitioner in dermatology or another in women’s health were doubtful that this information would be useful to them. “I don’t think that my patients will use this information.” Another survey respondent stated, “I would like to educate my patients, but I don’t have enough time in a 15-minute patient visit.”

Additional Evaluation

The question from chapter one was: Does a short educational course on the effects of reactive oxygen species, their lipid precursors, and specifically fried foods, enhance healthcare provider knowledge and stated commitment to affect practice decisions and provide patient education of this information? Furthermore, does this information impact stated commitment by healthcare providers to improve their own dietary choices?

Factor analysis was attempted on the assessment tool to clearly identify the elements of the survey. It was discovered, however, that the mixed elements of the tool did not lend themselves to this kind of analysis and did not provide any meaningful insight. Future tools will

need to be planned in advance to take advantage of this kind of scrutiny. When Cronbach's alpha was calculated for the elements of the tool based on the researcher's original design, intent and judgement, however, all three subsections of the tool had excellent scores.

In reviewing the two parts of the original research question and whether the final data in this study supports the utility of this educational brochure, the data displayed in Table III and the qualitative information provide some affirmation as to usefulness of this educational brochure. Participants indicated the brochure increased their knowledge and that it was presented in a graphically appealing and organized manner.

Of significant concern was the response to question 8 where both RN/students and professionals indicated that they believe their patients are not interested in learning about preventive medicine or healthy eating. Providers who believe in patient disinterest, may not take the time to share information. This represents a significant barrier to patient education and dissemination of this important health information. On the other hand, however, RN/student survey respondents (92% answered 4-5) and professionals (89% answered 4-5) when asked to respond to survey question #6: "This material will positively impact my professional interaction with patients and lead to discussions about the role of diet in coronary artery disease." This may overcome the prior barrier and facilitate dissemination of the information to patients.

For the next section of the survey related to the respondents own personal health commitment, question #10 briefly summarizes participants' aim to improve their health choices. "This material will positively impact my personal choices regarding diet and lead to a closer monitoring and reduction of dietary fat intake, including fried foods." For this question, RN/student participants (92% answered 4-5) and professionals (89% answered 4-5) overwhelmingly answered in the affirmative.

Analysis of tool

In analysis of the data it is important to realize that internal tests of reliability, such as Cronbach's Alpha, measure the reliability of scalar answers by comparing those with the same underlying construct (Warmbrod, 2014). For example, the first 4 questions had to do with various aspects of the respondent's valuation of the topic being presented. This yielded an Alpha score of 0.83 and indicates consistent positive and strong correlations within these construct items. Others constructs, such as questions 12 through 17 yielded a predictably lower reliability rating of 0.72, because the underlying construct was a self-assessment of the respondents own particular current health practices such as rest, exercise, stress management, interpersonal relations, and trust/spirituality, which may show greater variability. While 0.72 was lower, it was still in the acceptable range for internal consistency. When the psychological aspects of health were examined in isolation, questions 15-17, the reliability score was even lower at 0.53. This was no doubt due to differences in fundamental construct wording. This would need to be examined further in future studies by attempting to design questions that more closely examined the same identical constructs. The variability in this study could be confounded by variations in how well the question addressed the same construct.

Chapter 5 – Discussion of Findings

Introduction

The original intent of this project was to provide an educational program for nurse practitioners and other healthcare providers at three venues in Tennessee. Promoting educational programs related to cardiovascular disease risk reduction is especially cogent in the southern states of the United States, given the multiple risk factors in this region. Promoting health for vulnerable populations that may be poor, lack access to grocery stores with fresh produce, lack transportation, lack health literacy, be homeless, or mentally ill is imperative to forestall chronic disease risk (CDC, n.d.; Correll et al., 2017). Poor urban residents may be on a fixed income and lack the wherewithal to purchase fresh produce, even if available. Additionally, certain regional dietary habits – such as fried foods in the south, can hinder health promotion activities. While the educational offering for this project was positively received at the various venues it was offered, this project underscores the complexity of disseminating such material where it is most needed.

Discussion of the Tool Construction and Reliability

To answer the research question and attempt to measure the success of information transfer a tool was developed using Likert scales, a method often used to interpret this kind of data (Warmbrod, 2014). The method centers around specific constructs, ideas that are central to the research question, and asks questions in different ways about those underlying ideas. The degree to which they measure successfully the underlying construct depends on how skillfully they are designed.

The ideal situation with a Likert tool is to first test it on a smaller sample to measure the reliablity of the tool. Once the tool is verified, then it can be used reliably on the actual target

population fully. One of the limitations of this study was insuficient access to the target audience in advance to test the tool. Those professionals at hand were very limited and test numbers were too few to measure the tool reliabilty properly in a pilot study.

Measurement of the tool itself was performed using standard tests of reliablity such as Crohnbach's Alpha using statistical software such as SPSS by IBM and PSPP by GNU Software. Factor analysis was attempted on the entire tool, but the results of that method of anlaysis did not yield any real insight overall. Future studies on this may allow for improvement on the tool to further capture more information on the reciprical information transfer process.

Discussion of the Hypothesis Testing

The central hypothesis of this project was to discover whether the material enhanced the provider's knowledge based on their own self-assessment and whether they believed it would affect their practice decisions and patient teaching practices. This is an ambitious task considering how brief the interaction was to be. Attendees at the conference were already the target of a lot of new information being presented at the conference in a more formal way. Access to them was very brief in between conferences.

While the breaks at the conference were up to a 15-minutes between sessions, access to each provider as they passed through the lobby area was much shorter. A few who responded took the tool back to their hotel rooms overnight. Even fewer returned the tool the next day of the conference. The majority filled it out on the spot. Given the brevity of exposure, the information transferred had to be in a format that was easily understood, succinctly presented, and the tool accurately designed to measure this.

Given the difficulty in measurement under these circumstances, the reliability of the tool as measured with statistical tools to test the hypothesis was difficult. Self-assessment itself has

its own limitations. This is where the anecdotal comments lend some support of confidence to the underlying raw statistical data. Participants may be overgenerous in their own self assessments on the tool, but more than a few made comments about the plans they had for substantial changes in their own lifestyles. These comments went beyond mere politeness to a surveyor and bolster the confidence in the quality of information transfer in their own right. They also amplify and reinforce the findings of the second half of the research question dealing with the intent of the provider to alter their own life-style.

Brochure Evaluation

The first four questions on the tool involved an assessment of the brochure itself. Question one focused on an introduction to reactive oxygen species and the role of lipids. Question two centered around the role of lipids in heart disease. Question three assessed the value of the graphics, and question four was about the different types of fat in the diet. Question five was less closely related to the actual topics and centered on the readability and organization of the brochure, a slightly different construct. The scores on these different questions demonstrated a good reception to the brochure itself as is reflected in the previously stated results.

Willingness to Share Info with Patients and Family

The participant's willingness to share the information can be found in questions six through nine and also question eleven. In retrospect it can be seen that there is some divergence in the underlying construct of some of these questions. This has rendered some of the alpha scores lower because what is being measured in each question is slightly different. While each question does have bearing on the underlying research question, what is being asked in each is enough different than other questions in the class that statistical analysis is of less value in

understanding the importance of the question asked. For example, question six asks if the material will positively impact professional interactions while question nine askes about sharing with family. Professional interactions and family interactions are usually not quite the same. Telling your children, spouse, or other family members information such as this may be influenced by many other considerations than found in the brief interactions providers have in an office setting.

Personal Application

Questions 10 and 12 through 20 involved various aspects of personal assessment and may not seem on the surface to be related to the actual research question at first glance. For example, discovering how much a participant rests each night or whether their outlook on life was future oriented or not may not seem to answer the research question. Part of information transfer however, is to make sure that the value of the information being transferred is demonstrated to be of such value that the recipient commits to retaining it and passing it on.

Linking Findings with the Theory and Prior Research

Martha Rogers' *Unitary Human Beings* (Gil, 2014; Rogers, 1994), describes the concepts of how patterns and environmental fields are involved in the sharing of knowledge, offering choices, and empowering people to make needed changes in their lives. This is what is involved in the concept of reciprocity in the underlying theory. In the chain of information transfer, one weakness that can break the link is if the information being transferred is not valued. Getting a busy participant to pause and make a brief assessment of their own lives is part of getting them to evaluate the importance of making changes and personally applying the information to themselves. Once this occurs the likelihood of passing it on to others is higher.

Prior research in the field of health has produced the CREATION Health model (Creation Health, 2014). This theory behind this study builds on these concepts by identifying key elements needed for optimal health. By blending these concepts in the theory for this project the intent was to provide relevant important material in a format that would enable rapid transfer of important health information using these concepts as a guiding principle.

Limitations of the Research Process and Tool

There were several limitations in this study. The first identified limitation of this project includes use of the Likert scale to assess healthcare provider feedback on the brochure. There is conflicting evidence about the utility of this medium in evaluating responses.

Voutilainen et al. (2015) found that the Likert scale is more vulnerable to confounding factors than the VAS (visual analogue scale). Likewise, Kuhlmann (et al. 2016) found the VAS to be superior in regards to precision, reduced error, and increased ability to antithesize differences. Alternatively, in comparing the utility of the Likert scale versus a "VAS-global subjective outcome scale", Harland, Dawkin, and Martin (2015) found the Likert scale superior for responses.

The tool itself was not fully tested prior to final use and it may not accurately reflect the underlying constructs being measured and cannot measure at all other constructs which in retrospect might have been made clearer. Likert tools rely on the participants own judgement of what are arbitrary scores. While statistical measures of internal reliability, such as the Cronbach's alpha score, are useful tools, they rely on the similarity of the construct behind each question and may be skewed by unforeseen factors. It is for this reason that testing the tool is ideal so that what is being measured can be more clearly verified.

One obvious limitation of the research process in this case was the limited access to the targeted providers. Clearly more research would be of benefit to verify both the quality of information transfer and the degree that the providers have passed on the information. The sample size was limited to those participants willing to stop and answer the survey. This may have inherently introduced sample bias because it does not necessarily apply to all providers at the conference, merely those willing to stop and participate.

Another limitation of this project was the use of traditional paper medium to deliver the health education topic. Considering the wide range of electronic applications that most healthcare providers utilize – such as electronic health record, internet to look up drugs, online courses for continuing education credits, personal cell phone applications, email, etc, it makes sense to develop attractive, user-friendly electronic mediums for delivery of student projects. Furthermore, patients can benefit from brief, content-driven educational materials. Bernier and Archer (2015) found that students realized enhanced immersion, acquisition of knowledge, and retention with electronic delivery of information. In 2015 it was found that a blended use of digital mediums and face-to-face format was effective for teaching (Maloney et al., 2015). "Survey Monkey" could be used to improve participant access.

Another limitation of the project is health literacy for either healthcare providers or patients. Some features of health care literacy that can impact utility of this project include lack of knowledge of current evidence-based practice, educational level, and communication skills (Gutierrez, Kindratt, Pagels, Foster, & Gimpel, 2014). Additionally, racial and ethnic disparities or cultural literacy can play a role in understanding teaching about health. There exists a "socio-economic gradient in health literacy" (Bo, Friis, Osborne, & Maindal, 2014).

Additionally, this project could have been expanded to include "interprofessional education" with the aim of including other healthcare team members – such as more physicians, physician's assistants, nurses, and other stakeholders. Interprofessional education pinpoints the collaborative nature of healthcare and may enhance patient outcomes through theoretical, utilitarian, and systematic approaches (Walkenhorst et al., 2015). "Interventions that can enhance teamwork should focus on: valuing the perspectives of others; developing relational competence and resilience; employing reflective learning and shared decision-making skills; and incorporating principles of change theory for both individuals and systems" (Casimiro, Hall, Kuziemsky, O'Connor, & Varpio, 2015). Interprofessional education is a developing field and is expected to impact healthcare institutions and the academic setting (Jogerst et al., 2015).

Finally, receiving knowledge and imparting that knowledge in the clinical setting, or applying that knowledge to one's own lifestyle habits may be contradictory. Cognitive assent does not necessarily equal changed habits. "Outcome measures are highly desirable but often difficult to incorporate into performance measure sets because of vulnerability to influences outside the provider's control" (Porter, Larsson, & Lee, 2016). Myriad reasons could influence application of CREATION Health lifestyle interventions, including diet reform. Cost of a whole-foods diet compared to fast food, time to prepare a healthy diet compared to wait time for fast food, access to fresh produce in cities, and family acceptance are a few factors that affect implementation of a healthy diet.

Discussion of Bias and Sampling in Results

In as much as possible, nurse practitioners and master's nursing students (MSN) were targeted for this study. The rationale for this selection process was that nurse practitioners likely have similar training as the principal researcher, are readily accessible due to professional peer

affiliation in Tennessee Nurse Practitioners' Association and CANAP, as well as MSN students at Southern Adventist University. Beyond that, the study was open to nurse practitioners of all ages, practice foci, years of practice, gender, etc. Another idea is that nurses and nurse practitioners are taught to provide patient education to assist patients in adopting "positive health behaviors" (Nesbitt, Murray, & Mensink, 2014). There was no bias in evaluating results, as all samples were treated equally.

Bias may have been introduced, in that participants in research studies are likely more educated, are derived from a higher social framework, and may be more outgoing than those individuals who elect not to participate in research studies (Sedgwick, 2015). The argument could be made that the study participants only reflect nurse practitioners from Tennessee, and this could be viewed as a source of bias. However, many of the respondents originated from diverse regions and may return to practice in those locales. This is especially true for student nurse practitioners.

Time constraints provided a likely bias. At the Tennessee Nurse Practitioners Association conference, the attendees had access to the principal researcher's table primarily before, after, and in-between meetings. The in-between meeting time was perhaps 10-15 minutes. This limited exposure to the material. Similarly, the CANAP meeting was of short duration.

Finances were another source of bias. Due to the cost of travel and printing of materials, this study was limited to the state of Tennessee. This limits exposure of the material in this study.

Recommendations for Clinical practice

The information about ROS, dietary lipids, and their role in health is important information. Many of the diseases of mankind support the cliché that "we dig our graves with our teeth." The role of diet and health has been the subject of many research projects. But passing that information along to the patient has been a serious challenge. Passing along relevant information which is useful for our patients in a timely, understandable way, and in a manor suited to not only convey the information, but impress its importance sufficiently for the client to incorporate it into their lives is perhaps the most challenging of all. One method to assist in the multifaceted problem is a personal commitment to learning new information and incorporating it into one's own life-style. Beliefs not deemed important enough to do that are rarely passed on effectively.

Suggested Health Policy Changes

Several key changes in policies could be implemented to positively impact community health.

1. Change marketing to children by restricting fast food/junk food access in schools (Hawkes et al., 2015).
2. Enforce consistent labeling rules, so that the product language is clear and unambiguous (Miller & Cassady, 2015).
3. Examine agricultural subsidies (Siegel et al., 2016).
4. Examine federal guidelines regarding unhealthy government-subsidized food programs (Sims, 2016).
5. Expand role of nurses in healthcare policy-making to reduce cardiovascular risk (Saffi et al., 2014).

6. Incorporate CREATION Health principles for overall health (Creation Health, 2014).

Suggested Changes for Education

Effective promotion of a healthy diet should begin in the home and with school-based education (Marcotte et al., 2018; Smith, St. George, & Prado, 2017; Vaduganathan, Venkataramani, & Bhatt, 2015). The parents can set an example of healthy eating by avoiding high fat and fried foods as well as teach their children how to make healthy choices (Hawkes et al., 2015). Schools can also play a role in educating and promoting healthy eating (Dudley, Cotton, & Peralta, 2015).

Clinical Significance

The implications for clinical practice include several features. To receive current, evidence-based educational material about cardiovascular disease risk factors is important to healthcare providers. Healthcare providers need to be aware of current trends and research in order to effectively provide patient education. Research provides the underpinnings for healthcare and promotes translation of guidelines into practice. Information that is accessible, affordable and promotes compliance with recommended guidelines for primary prevention of heart disease through healthy lifestyle modification is the goal (Oliveira, Avezum, & Roever, 2015). Patient education has been demonstrated to improve adherence to treatment aims and reduce unhealthy outcomes (Iuga & McGuire, 2014).

The practice changes suggested by this study include incorporating education, for nurse practitioners, and in the patient encounter, regarding dietary risk factors for heart disease. Serum lipid profile testing is recommended (Downs & O'Malley, 2015). Lifestyle recommendations should be considered in a balanced approach to coronary artery disease risk reduction (Saffi, Polanczyk, & Rabelo-Silva, 2014). Cardiovascular risk reduction is best implemented by

primary preventive [education] approaches (Hofer, Sussman, & Hayward, 2016; Jenkins et al., 2017; Macknin et al., 2015).

Patient education improves treatment adherence, improves health outcomes, and reduces liability risks (Finset, 2018; Posner, Severson, & Domino, 2015). Nurse practitioners can effectively "decode and translate" medical jargon to more understandable layman's language (Kuhrt, 2017). When patients understand the health teaching material, they are more empowered to make healthy decisions. Motivational interviewing favorably influences patient adherence to health lifestyle choices and may positively impact cardiovascular health (Lee, Choi, Yum, Doris, & Chair, 2016).

Incorporating the CREATION Health paradigm, with its balanced approach to the different parameters that influence health, can pave the way for discussion about a holistic approach to treatment. The distinctive contributions that this design offers are a rational, coherent, and holistic concept to aid in prevention of disease and promotion of overall health. Dietary interventions, that include reduction of fat intake, may lead to a reduction in chronic and preventable disease states (Ludwig, 2016; McDougall et al., 2014). Prevention and reduction of non-communicable disease states, including cardiovascular disease, through lifestyle changes can reduce costs of medical care (Brown & Griendling, 2015; Catapano et al., 2016).

Ideas to Enhance Project for Future Applications

To improve this study, expanding the survey to include other healthcare providers – such as physicians, physicians' assistants, nurses, and pharmacologists would be ideal. Additionally, the study should be expanded to further geographic regions for a more balanced blend. This would enable more precise information related to dietary choices, culture, etc.

Since many healthcare educational continuing education units are offered on the internet, this would be a better way to reach more people with this information. Language, cost, access, and time can be limiting factors, but this can be overcome through internet tools. It has been found that virtual medical training can be offered through technology and even by distance education via the internet (Feng, Zhao, & Li, 2018).

Developing technology-rich teaching mediums for medicine, both for providers and patients may be the wave of the future and will be less expensive than traditional mediums. However, use of online videos, mobile devices with health applications, interactive games, webinars, etc., will not replace all traditional teaching (Guze, 2015). With the options of blended presentation of educational material, with online material and face-to-face education is more cost effective than face-to-face teaching alone (Maloney et al., 2015).

Education

Education begins at birth and is lifelong. It is part of the reciprocal process fundamental to the theory of this research project as Rogers alluded to when she spoke of sharing knowledge (Gil, 2014; Rogers, 1994). Education also involves acquiring knowledge through research and passing it on in a meaningful way as this project has attempted. The more important information is, the wider the approach should be made to convey it.

Research

This study aligns with the American Nurses Association (2015) goals of expanding knowledge through research:

Provision 55 “Maintenance of competence and continuation of professional growth;

Provision 7.1 “Contributions through research and scholarly inquiry”

Late in the implementation phase of this study, key theories of learning were examined to augment the nursing theories originally posited in the study. These theories explain the processes involved in moving the student – in this case the nurse practitioner, and, subsequently, the patient, from passive acquisition of information to active assimilation and application of the material learned. Saljo (1979) defines the "learning as the abstraction of meaning and learning as an interpretative process in understanding reality." Trigwell, Prosser, and Waterhouse (1999) found that aiding students to change and establish new cognitions can influence outcomes.

The combined nursing theories and learning theories help provide concomitant support to the CREATION Health model. Motivational interviewing can promote positive health behaviors (Copeland, McNamara, Kelson, & Simpson, 2015). The clinical influence of the Transtheoretical Model likewise has been shown to improve health outcomes with reduction of dietary fat (de Menezes, Mingoti, Cardoso, de Deus Mendonça, & Lopes, 2015; de Menezes, Mingoti, de Deus Mendonça, & Lopes, 2017; Moreira, Santos, Menezes, & Lopes, 2014). Furthermore, the perception of self-efficacy indicates that when individuals believe that they are capable of positive change, have the determination to change, and have the ability to overcome any obstacles in their path, then positive change behaviors and outcomes will occur (Schwarzer, Luszczynska, Benyamini, Johnston, & Karademas, 2016).

Clinicians need to further discover and understand the mechanisms of ROS and their impact on health and work to define many different approaches to mitigate the damage they do. Research into the mechanism must also be matched with research into methods of conveying the information obtained in ways that result in life-style changes for their patients.

Summary and Conclusion

This educational offering on lipids, ROS, and health contributed to nurse practitioner and other healthcare provider awareness, motivation, and commitment to professional practice change, patient education, and personal involvement in health change. The quantitative and qualitative responses to this presentation affirm the utility of this project in healthcare provider education. This project has contributed to the body of nursing knowledge and aim of providing education to reduce health risks for vulnerable populations.

This study set out to determine the impact that an educational presentation on dietary choices and the effect that information would have on both patient teaching and personal choices of a sample of providers attending a professional conference. The information was of a complex nature and the challenge was to present it in an understandable method that would at the same time adequately emphasize its importance in a way calculated to alter both patient teaching but promote healthy changes in the participant's life-style.

These were ambitious targets given the brevity of the actual contact with the participants. From the responses received it was a success. Participants indicated in their responses a high degree of understanding both of content and how important the material was. They offered not [-['’p[panecdotal responses that supported the underlying statistical data and added emphasis to it.

Several limitations were exposed. Given the newness of some of the information and the brief exposer time limitations at the conference, this was not surprising. What it points to is a need for refinement of the process, the need for further research, and a larger effort to disseminate this information.

This study was costly for a student budget and involved travel. All three venues were supportive of student initiatives and research. It would be ideal to expand this educational offering as a recognized continuing education unit (CEU).

While financial goals are a recognizable force that promotes new drug research, unless a drug can be found to offset the negative consequences of ROS, that is unlikely to be a major help in this case. But given the increasing cost of health care, as the focus is placed on reducing risk and saving costs, it may be possible to find resources needed for wider research and teaching on this important issue after all.

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Appendix A – Likert Scale tool

Likert Scale

1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree	1	2	3	4	5
1 This teaching brochure enhanced my knowledge of lipids and reactive oxygen species.					
2 This teaching brochure enhanced my knowledge of the role of dietary fats in increasing coronary artery inflammation and cardiovascular disease.					
3 The graphics in this brochure enhanced the teaching about lipids and inflammation.					
4 The graphics in this brochure enhanced my knowledge about the different types of dietary fats.					
5 The text was easy to understand and presented in an organized manner.					
6 This material will positively impact my professional interaction with patients and lead to discussions about the role of diet in coronary artery disease.					
7 I regularly engage patients in discussions about preventive nutrition, including dietary influence of a high fat diet.					
8 Patients that I see are interested in learning more about preventive medicine, including healthy eating.					
9 This material will be shared with my family members.					
10 This material will positively impact my personal choices regarding diet and lead to a closer monitoring and reduction of dietary fat intake, including fried foods.					
11 The material about the CREATION Health model added to the overall presentation about health.					
12 I am interested in improving my health through making better choices.					
13 I rest 8 hours each night.					
14 I have a stress-free *environment* that enhances my well-being.					
15 I exercise regularly and lead an *active* lifestyle.					
16 I find that *trust* and a faith/spiritual perspective enhances my quality of life.					
17 My *interpersonal relationships* are satisfying and important to me.					
18 My *outlook* is positive and future-oriented.					
19 My daily overall *nutrition* focus is healthy with plenty of fresh fruits, vegetables, whole grains, and a minimum of unhealthy dietary fats such as deep-fried foods.					
20 The websites about healthy recipes and overall health practices are a benefit to me, my family, or my patients.					

Appendix B – Budget

Item	Cost
TNPPA conference cost	-$525.00
Nashville Airport Hotel	-$188.04
Meals	-$108.53
Staples printing costs	-$626.47
Mileage	-$201.78 (342 x 0.59 per mile)
CANAP membership	-$50.00
Subtotal	-$1699.82
CANAP DNP scholarship	*+$1000.00*
Total out-of-pocket expense	-$699.82

Appendix C – IRB Approval

From: IRB
Sent: Thursday, March 15, 2018 12:37 PM
To: Heather Bowen
Subject: IRB Approval Letter-Heather Bowen

March 15, 2018
Principal Investigator: Heather Bowen

Research Project: Lipids, Reactive Oxygen Species, and Health

IRB Tracking Number: 2017-2018-080

Dear Heather,

It is a delight to inform you that the Institutional Review Board examined your research study proposal and supporting documents at the IRB committee and has approved your research request as **expedited.** We wish you the very best as you move forward with this study and look forward with this study and look forward to reading your findings when they are ready.

If there are minor changes to this research, before making those changes please notify us by completing and submitting FORM B (Certification of Modification, Annual Review, Research Termination, or Research Completion). Please submit applications to irb@southern.edu. If substantial changes are planned you, as the principal investigator, should submit a new IRB FORM A application.

Many blessing to you as you move forward. Please let us know if there is anything else we can do to assist you with this research study.

Always in His service,

Cynthia
Cynthia
Cynthia Gettys, Ph.D.
IRB Chair
Southern Adventist University
423-236-2285
cgettys@southern.edu
"I applied my mind to **study** and to explore by wisdom all that is done under the heavens…" - Ecclesiastes 2:13
"Research is to see what everyone else has seen and to think what nobody else has through." - Albert Szent-Gyorgyi

Appendix D – Data Analysis

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
Question1	4.25	.500	4
Question2	4.25	.500	4
Question3	4.00	.816	4
Question4	3.50	1.732	4
Question5	5.00	.000	4
Question6	4.75	.500	4
Question7	4.50	.577	4
Question8	3.50	1.000	4
Question9	3.50	1.915	4
Question10	4.00	.816	4
Question11	4.50	.577	4
Question12	4.75	.500	4
Question13	2.50	1.732	4
Question14	2.00	.816	4
Question15	2.50	1.915	4
Question16	4.50	.577	4
Question17	4.25	.500	4
Question18	4.75	.500	4
Question19	2.75	.500	4
Question20	1.00	2.000	4

Notes on N for each of the following reliabilities:

variables 1-4, and 6-9 N= 103

Variables 10-19, N = 93

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.826	.833	4

Inter-Item Correlation Matrix

	Question1	Question2	Question3	Question4
Question1	1.000	.678	.410	.347
Question2	.678	1.000	.560	.541
Question3	.410	.560	1.000	.793
Question4	.347	.541	.793	1.000

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.780	.794	4

Inter-Item Correlation Matrix

	Question6	Question7	Question8	Question9
Question6	1.000	.535	.407	.616
Question7	.535	1.000	.570	.398
Question8	.407	.570	1.000	.420
Question9	.616	.398	.420	1.000

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.804	.811	10

Inter-Item Correlation Matrix

	Question12	Question13	Question14	Question15	Question16	Question17	Question18	Question19	Question10	Question11
Question12	1.000	.163	.224	.258	.351	.234	.247	.251	.402	.391
Question13	.163	1.000	.608	.414	.183	.231	.231	.346	.190	.257
Question14	.224	.608	1.000	.542	.248	.347	.269	.471	.212	.254
Question15	.258	.414	.542	1.000	.263	.316	.314	.587	.175	.142
Question16	.351	.183	.248	.263	1.000	.342	.206	.229	.313	.209
Question17	.234	.231	.347	.316	.342	1.000	.669	.234	.185	.170
Question18	.247	.231	.269	.314	.206	.669	1.000	.315	.266	.185
Question19	.251	.346	.471	.587	.229	.234	.315	1.000	.298	.157
Question10	.402	.190	.212	.175	.313	.185	.266	.298	1.000	.621
Question11	.391	.257	.254	.142	.209	.170	.185	.157	.621	1.000