

ABSTRACT

Title of Thesis: SUPPLEMENT USE AMONG A PRE-COLONOSCOPY POPULATION

Shanelle Nasheka O'Connor
Master of Public Health, 2018

Thesis Directed By: Dr. Evelyn C. King-Marshall, Behavioral and Community Health

In the United States, Colorectal Cancer (CRC) is the third leading cause of cancer-related deaths in both males and females. In 2017, it was estimated that 50,260 people would die from colon cancer alone (American Cancer Society, 2017). There are several behavioral factors that are known to reduce the risk of CRC. Studies have shown that less smoking, reduced heavy alcohol use, engaging in regular physical activity and healthy eating habits are associated with a lower risk of developing colorectal cancer (Lynes et al, 2016). In recent studies, researchers found an inverse relationship between Calcium and Vitamin D use and colorectal cancer through various mechanisms (Chan & Giovannucci, 2010). However, the role of other supplements, including multi-vitamins, vitamin C, and vitamin B6, remains uncertain; there have only been a few studies conducted with these other supplements and their role in colon cancer risk reduction. According to Consumer Survey on Dietary Supplements, 68% of U.S. adults report that they use a dietary supplement and

over 50% are regular users. NHANES survey shows that women, older adults and whites use supplements more than their counterparts (Picciano, 2005).

A survey was administered to patients prior to their colonoscopy appointment to investigate perceived and actual understanding of the procedure, health literacy, and general health. Participants were selected from eligible patients (18 years or older; could read/write English; cognitively able to fill out survey) scheduled for a colonoscopy at either a university hospital-based center or a university-affiliated outpatient endoscopy center situated in Alachua County, Florida from September 2011 through October 2013 (Curbow et al, 2015). The goal of this proposed Master's thesis capstone is to conduct a secondary analysis of data collected from patients in this study to determine associations regarding supplement use with various variables such as demographic factors, perceived health literacy, informed about CRC, concern about CRC, reason for colonoscopy and general health. These associations will help us to better understand how these variables impact supplement use among this population.

SUPPLEMENT USE AMONG A PRE-COLONOSCOPY POPULATION

by

Shanelle Nasheka O'Connor

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master in Public Health
2018

Advisory Committee:

Dr. Evelyn C. King-Marshall, Chair

Dr. Barbara A. Curbow

Dr. Mary A. Garza

© Copyright by
Shanelle Nasheka O'Connor
2018

Acknowledgements

To my advisor, Dr. King-Marshall, thank you for your guidance throughout my time in the program and for helping me grow as a student and as a person.

To my thesis committee, Dr. Curbow and Dr. Garza, thank you for your support and guidance throughout the thesis process.

To my family and friends for their continual support, thank you for encouraging me and helping me to realize my potential. I know that without you I would not have gotten this far in my academic career.

Table of Contents

Acknowledgements.....	ii
Table of Contents.....	iii
List of Tables.....	v
List of Figures.....	vi
Chapter 1: Introduction.....	1
Statement of Research Problem.....	1
Guidelines for Supplement Use.....	2
Current Supplement Recommendations.....	2
Current Supplement Trends.....	4
Colon Health Recommendations.....	5
Research Questions.....	6
Definition of Terms.....	6
Table 1: Definitions.....	6
Significance of the Project.....	8
Chapter 2: Background.....	11
Conceptual Framework.....	11
Figure 1: Conceptual Framework Diagram for Supplement Use.....	12
Cancer.....	13
Colorectal Cancer.....	14
Colorectal Cancer Prevention.....	15
Supplement Use.....	18
Supplement Use and Colorectal Cancer Prevention.....	19
Chapter 3: Methods.....	20
Overview of Study.....	20
Study Sample.....	20
Measurement.....	21
Operationalization of Variables.....	21
Health Outcome.....	21
Demographic Variables.....	22
Perceived Health Literacy.....	22
Concern about CRC and Reason for Colonoscopy.....	23
General Health.....	23
Data Cleaning.....	24
New Variables.....	24
Analysis Plan.....	25
Table 2: Analysis Plan.....	26
Chapter 4: Results.....	28
Overview.....	28
Table 3: Frequencies of Variables.....	28
Rate of Supplement Use.....	30
Table 4: Supplement Use Analysis.....	31
Demographics.....	31
Age Categorical.....	31

Age continuous	33
Gender	33
Race.....	34
Table 5.1: Age, Gender and Race Analysis	35
Income.....	36
Education	37
Table 5.2: Income and Education Analysis	38
Perceived Health Literacy	39
Categorical	39
Continuous	39
Informed about CRC.....	39
Table 6: Perceived Health Literacy and Informed about CRC Analysis	40
Concern about CRC	41
Table 7: Concern about CRC Analysis	42
Reason for Colonoscopy	42
Routine based on age	42
Family history of CRC.....	43
Follow-up to previous colonoscopy.....	43
Follow-up to an abnormal test	44
I have been having symptoms or problems.....	44
Table 8: Reason for Colonoscopy Analysis.....	45
General Health	46
Health Status	46
Table 9: Health Status Analysis	46
Physical Health	47
Table 10: Physical Health Analysis	47
Mental Health.....	47
Table 11: Mental Health Analysis	48
Chapter 5: Discussion	49
Summary of Central Finding	49
Implication of Findings.....	51
Limitations and Strengths	52
Directions for future Research	53
Conclusion	54
Appendices.....	56
A. Table 12: Recoding of Variables	56
B. Pre-colonoscopy Survey.....	59
C. Caregiver Survey.....	65
D. Human Subject Research Determination Form	73
E. Timeline.....	74
References.....	76

List of Tables

TABLE 1: Definition of Terms

TABLE 2: Analysis Plan

TABLE 3: Demographics, Colorectal Cancer Variables and Health Related Variables
Frequencies

TABLE 4: Supplement Use Analysis

TABLE 5.1: Age, Gender and Race Analysis

TABLE 5.2: Income and Education Analysis

TABLE 6: Perceived Health Literacy and Informed about CRC Analysis

TABLE 7: Concern about CRC Analysis

TABLE 8: Reason for Colonoscopy Analysis

TABLE 9: Health Status Analysis

TABLE 10: Physical Health Analysis

TABLE 11: Mental Health Analysis

TABLE 12: Recoding of Variables

List of Figures

FIGURE 1: Conceptual Framework Diagram

Chapter 1: Introduction

Statement of Research Problem

While most professional nutrition organizations, including the Academy of Nutrition and Dietetics, do not advocate that healthy adults use vitamin and mineral supplements, these organizations do recognize that there are population subgroups for which a supplement may be warranted to ensure that nutrient needs are fully met (Rodriquez & DiMarco, 2009). A supplement is a substance that is ingested and contains a dietary ingredient that provides additional nutritional value to one's diet (ODS, 2011). Scientists have not reached a uniform consensus on whether the use of supplements on a routine basis is beneficial, yet a large portion of the U.S. population (about 2/3^{rds}) have used multivitamins and other dietary supplements (Bailey et al, 2011; Radimer et al, 2004; Foote et al, 2003; Dickenson et al, 2014). Renowned scientists have suggested the regular use of multivitamins for adults as a way to obtain nutrients they do not receive from their diet, to guarantee that the body functions properly and to support health in general (FDA, 2017). A new explanation behind the suggestion of supplement use is that they have the potential to protect against chronic disease (Frei et al, 2014; Ames et al, 2007; Willett and Stampfer, 2001). On the other hand, some scientists oppose the regular use of supplements; mainly because supplements have not been proven to produce considerable protection against chronic diseases particularly heart disease and cancer (Guallar et al, 2013). However, other scientists believe that the regular use of supplements should be further investigated for specific populations (middle aged and

elderly) to safeguard the appropriate dietary intake of essential vitamins and minerals (FDA, 2017).

Guidelines for Supplement Use

There are several suggested guidelines for supplement use. First, it is important to know the composition of the supplement that is used and how it will react with the body. Although supplements have provided positive health effects, some have produced negative side effects. Second, it is also important to check the Percent Daily Value to ensure that the amount taken is correct and is not more than the recommended amount (FDA, 2017). Lastly, it is advised that individual check to see what research has been done on the supplements they use. Researchers have demonstrated that several supplements have certain benefits and are linked with positive health outcomes (Albert et al, 2008; Ruxton, 2004; Prentice et al, 2013). Nevertheless, researchers need to conduct clinical trials on supplements that we have no information about so we can understand their effects (both positive and negative).

Current Supplement Recommendations

There are several supplements that have been recommended for use by certain populations. Folic acid supplementation has been shown to prevent neural tube defects and other folic acid-sensitive congenital malformations. Therefore, it is recommended that pregnant women and women of childbearing age consume 0.4-1.0 mg of folic acid daily as part of their diet (Chitayat et al, 2016). Along with folic acid, iron supplements are also recommended for pregnant women (Rioux and LeBlanc, 2007). Breastfed infants need vitamin D, so it is suggested that new mothers take vitamin D supplements for the

benefit of their child (CDC, 2015). Moreover, Vitamin D deficiency is epidemiologically linked to prostate and colon cancer, especially among Black men. Thus, vitamin D use is suggested for Black men due to the high prevalence of vitamin D deficiency among this population; vitamin D is essential for bone formation, resorption, and mineralization (Murphy et al, 2012).

Calcium not only helps to manage osteoporosis, but a diet high in calcium can prevent the development of osteoporosis. The use of calcium is advised by practitioners to those who have osteoporosis because calcium plays a vital role in preventing fractures and the loss of bone mass (Sunyecz, 2008). Along with vitamin D and calcium, the *National Institute on Aging (NIA) Vitamin and Mineral Intake Guidelines* for seniors recommends that the elderly include Vitamin B12, and iron supplements as part of their diet. Vitamin B12 supplements are suggested for the elderly because they have problems absorbing vitamin B12 that is found in foods naturally; this vitamin is needed keep the body's nerve and blood cells healthy and to prevent weakness/tiredness among this population (ODS, 2011). Anemia is common in the elderly and its prevalence increases with age; the most common causes are chronic disease and iron deficiency (Smith, 2000). Iron supplements are especially needed among this group to decrease likelihood of anemia and iron is needed to generate red blood cells which deliver oxygen to tissues throughout the body (NIA, 2013). Lastly, it is advised that vegans also consider taking Vitamin B12 supplements which comes mostly from meat, fish and dairy products, foods that are not allowed in their diet. Individuals with any heart condition have been guided to take fish oil (omega-3 fatty acids) because research has suggested that it promotes heart health (ODS, 2017). The supplement recommendations for each sub population

highlight the importance of using these supplements and the health benefits that accompany it.

Current Supplement Trends

Dietary supplement usage is common among Americans. According to 2011-2014 National Health and Nutrition Examination Surveys (NHANES) data, approximately half of Americans use dietary supplements, with multivitamin/mineral supplements (MVS) consumed most frequently (Gahche et al, 2017). Supplements are used mostly among White women, but other populations (men, racial minorities, low income and low education individuals) are thought to be missing out on the benefits of supplement use (Blumberg et al, 2016). Trends in dietary supplements were assessed among individuals living in the US every 2 years from 1999 to 2012; supplement use was found to be associated with several sociodemographic variables. Supplement use was highest among Non-Hispanic Whites (58%) and lowest among Mexican Americans (29%) (Kantor et al, 2016). Women were also more likely to use supplements than men, 58% and 45% respectively (Kantor et al, 2016). Supplement use increased with age, with 72% of adults 65 years or older reporting use compared with 40% of adults aged 20-39 years (Kantor et al, 2016). As people get older they may not obtain these nutrients from their diet so they rely on supplements as the source of these essential nutrients. There is a correlation between education and the use of supplements, with those having higher education using more supplements compared to those with lower education. Supplement use among individuals with 4 or more years of secondary education (65%) was greater compared to those with less than a high school diploma (37%) (Kantor et al, 2016). Supplements have been shown to decrease the risk of developing certain diseases and to increase overall

health (Kantor et al, 2016). Along with supplements, there are different approaches that are recommended for individuals to implement in their lives in order to keep and maintain their health (Young, 2014). This is particularly true for preserving and maintaining colon health (Chan and Giovannucci, 2010).

Colon Health Recommendations

There are several strategies individuals can adapt to their lifestyle to improve the health of their colon and lower their risk of developing colorectal cancer. First, it is essential to maintain a healthy diet; consuming more fruits, vegetables, grains and nuts which aid in the normal function of the bowel. However, it is best to avoid red meat, processed food and foods high in fat (Nomura et al, 2016). Second, those who are obese or overweight have an increased risk of developing colorectal cancer. Therefore, regular engagement in physical activity each week (150 minutes of moderate-intensity) is advised in order to maintain a healthy weight and decrease the risk of obesity (Howard et al, 2008; American Cancer Society, 2017). Third, alcohol and tobacco usage should be decreased in order to improve the health of the colon. The use of alcohol should be limited (<12.5 grams per day, about one drink) in order to maintain a colon that is healthy and functional (American Cancer Society, 2017). In regards to tobacco use, smoking can lead to carcinogens entering the colorectal mucosa either through ingestion or the circulatory system. These carcinogens then result in the formation of adenomas, which are precursor lesions that disrupt the normal function of the colon and increase the risk of colorectal cancer (Paskett et al, 2007). Finally, once individuals (both men and women) reach the age of 50, it is recommended that they get screened for colorectal cancer.

Screening is needed so that polyps and cancer can be detected early and the correct treatment administered to the individual (American Cancer Society, 2017).

Research Questions

1. Among a group of pre-colonoscopy individuals, how do rates of supplement use differ by various demographic and conceptual characteristics?
 - 1.1. What is the rate of supplement use (type of supplement use, any supplement use and protective supplement use)?
 - 1.2. How is this rate associated with age, gender, race, income, and education?
 - 1.3. How is this rate associated with perceived health literacy and informed about CRC?
 - 1.4. How is this rate associated with concern about CRC and reason for colonoscopy?
2. Among a group of pre-colonoscopy individuals, is general health associated with supplement use (type of supplement use and any supplement use)?
 - 2.1 How is health status associated with supplement use?
 - 2.2. How is physical health associated with supplement use?
 - 2.3. How is mental health associated with supplement use?

Definition of Terms

Table 1: Definitions

Term	Definition
1. Adenomas	The most common precancerous colon polyp, which is believed to be the precursor for about 80% of CRC (Cleveland Clinic, 2017).
2. Carcinogens	Substances that are known to cause cancer (American Cancer Society, 2017).
3. Carcinoma	Cancer that begins in the skin or in tissues that line or cover internal organs (National Cancer Institute, 2017).
4. Colonoscopy	A screening or diagnostic exam for colorectal cancer in which a lighted tube with a small camera on the end is used to examine the entire length of the colon and rectum. If polyps are found, they may be removed during the test (American Cancer Society, 2016).
5. Colorectal Cancer	Cancer that occurs in the colon or rectum; the colon is part of the large intestine or large bowel and the rectum is the channel that connects the colon to the anus (Colon Cancer Alliance, 2017).
6. Health Disparity	“A particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their racial or ethnic group; religion; socioeconomic status; gender; age; mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion” (Healthy People 2020, 2017).
7. Polyps	Abnormal growths inside the colon or rectum that may later become cancerous if not removed (Colon Cancer Alliance, 2017).
8. Supplements	A nutrient that may be added to the diet to increase the intake of that nutrient (Office of Dietary Supplement [ODS], 2017).
Included in analysis:	
9. Concern about Colorectal Cancer	How susceptible people think they are of developing colorectal cancer (Orji et al, 2012).
10. Informed about Colorectal Cancer	What people think they know about colorectal cancer (Greiner et al, 2005).
11. Reason for Colonoscopy	A trigger that elicits a response for people to engage in a health behavior, in this case it is why the colonoscopy was ordered and its association with supplement use. (Orji et al, 2012).

12. Multivitamins	It is associated with better performance or energy, weight control, or improved immunity, typical dosage is one pill daily (ODS, 2106)..
13. Aspirin	It limits the clumping of platelets, which can prevent a heart attack or stroke form occurring, typical dosage (75-325mg) is based on doctor's recommendation (Mayo Clinic, 2017).
14. Calcium	It is associated with maintaining and supporting the structure of bones and teeth and helping in the process to release hormones and enzymes, typical dosage is 1000 and 1200mg daily for adult men and women respectively (ODS, 2016).
15. Vitamin C	It is associated with protecting cells from the harm caused by free radicals and making collagen, a protein that aids in the wound healing process, typical dosage is 90 and 75mg daily for adult men and women respectively (ODS, 2016).
16. Vitamin D	It is associated with aiding cells to uptake calcium, muscle movement, carrying messages through the nerve form the brain to different parts of the body and the immune system's role in fighting invaders such as bacteria/viruses, typical dosage is 600 IU(402 mg) daily for adult men and women (ODS, 2016).
17. Fish Oil	It is a source of omega-3, which is needed to improve the structure of the cell membrane and production of signaling molecules, typical dosage is 1.6g and 1.1g daily for adult men and women respectively. (ODS, 2016).

Table 1: Definition of terms that the audience may not know but need to understand in order to comprehend the concepts in this paper.

Significance of the Project

The significance of this proposal will be for this population of pre-colonoscopy individuals to understand what supplements are and to communicate with their doctor to determine if they are a good candidate for using supplements. It is crucial to identify (1) groups using and not using supplements, (2) the facilitators and barriers to supplement use and (3) interventions to reduce disparities in supplement use. It is very important that people convey all health practices, whether modern, complementary or alternative, to

their health care provider. This provides them with a good understanding of what they are actively doing to manage their health and help them to provide coordinated and safe care (ODS, 2017).

First, it is important that people understand the purpose of supplements and how they should be used. It is believed that supplements, such as vitamins, minerals and herbal products have the essential nutrients required to maintain or improve health (ODS, 2016). Supplement users should know that supplements are not a substitute for a healthy, nutritious and varied diet (Dickinson et al, 2015). People need to understand that supplements should be taken only if a medical care provider determines they are not able to acquire the essential nutrients from their normal diet. This can happen as a result of not consuming a variety of foods or the body lacking the ability to absorb these nutrients directly from the environment or from food. Dietary supplements can consist of several ingredients, such as vitamins, minerals, amino acids, and herbs or other botanicals, which the body requires to function. It is also necessary to educate individuals as to the impacts (positive and negative) that supplements can have on their health. Researchers have proven that some supplements can provide health benefits, but have not confirmed the effects of other supplements (ODS, 2017).

Second, it is essential that individuals talk with their health care providers before they decide to use supplements. Doctors should explain if and how supplement(s) will affect their patients. Some dietary supplements may interact with medications that a person is taking or they may be considered hazardous if you have a medical problem (ODS, 2017). Some dietary supplements have yet to be assessed in certain populations, such as pregnant women, nursing mothers, or children (ODS, 2017). These populations

need to be very careful of what they are introducing into their body; supplements can potentially lead to negative side effects. The U.S. Food and Drug Administration (FDA) is responsible for regulating dietary supplements, but the regulations are different from and less stringent than regulations for prescriptions and over-the-counter drugs (ODS, 2017). Prescriptions are tightly regulated and require a doctor's approval because they have the potential to lead to adverse health outcomes. Similarly, supplements should be taken seriously, not taken haphazardly, but taken with recommendation from a doctor.

Supplements have been shown to have some positive effects on health. However, certain groups that can benefit from using supplements are not typical users. Non-Hispanic White women are more likely to use supplements; especially those of among the middle and older age groups, with high education and high income (Jasti et al, 2003). Black, Hispanic, Asian, Pacific Islander and Native American women disproportionately use supplements less than White women (Jasti et al, 2003). There might be barriers and cultural beliefs that prevent minority women from using supplements. Moreover, the number of men who take supplements is less than the number of women who use supplements (Hensley, 2011). There are several factors that influence supplement use; these include age, race, gender and culture. Disparities in supplement use needs to be further investigated to understand why these disparities exist and how they came about.

Chapter 2: Background

Conceptual Framework

A theory or conceptual framework presents a logical and organized way of comprehending events or situations that happen. It usually contains a set of concepts, definitions, and propositions that try to explain or predict events or outcomes that occur by expounding upon the relationships that exist between variables (Glanz et al, 1997). As illustrated in Figure 1, a conceptual framework consisting of several constructs would be used to explain supplement use among a population of people who are scheduled to have colonoscopy. The first construct is demographic factors (age, gender, race, income, and education). Demographic factors are characteristics that define a person and these factors significantly influence health behaviors that individuals choose to engage in (Foote et al, 2003).

The second construct is perceived health literacy; "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (Institute of Medicine, 2004, pg 31; National Network of Libraries of Medicine, 2017). The understanding of information pertaining to CRC influences supplement use. Another construct that is tied with perceived health literacy is informed about CRC. The third construct, informed about CRC is defined as what people think they know regarding a certain subject or topic (Greiner et al, 2005). In this case, it is how informed people are about colon and rectal cancer. The fourth construct, concern about CRC refers to the probability that individuals think they are vulnerable of acquiring a health condition (Orji et al, 2012). In this case, it

is measured by how concerned people are about having colon or rectal cancer. It can be hypothesized that those with a high perceived susceptibility would have taken measures, such as using supplements, to reduce their risk of developing CRC. The fifth construct is reason for colonoscopy; it is a trigger to engage in a health behavior. The trigger can be events, people, or things that prompt people to change their behavior. The trigger can include internal cues such as a harmful change in the body or discernment of signs and indicators of impairment (Orji et al, 2012). Individuals may choose to have a colonoscopy because they are experiencing symptoms of CRC or a follow-up to an abnormal test or previous colonoscopy. The last construct is general health, with health status, physical and mental health as underlying variables. People who are actively trying to maintain or improve their health overall would be more likely to consider using supplements (NCCIH, 2014). These constructs, individually and collectively, play an essential role in supplement use among this population.

Figure 1: Conceptual Framework Diagram for Supplement Use

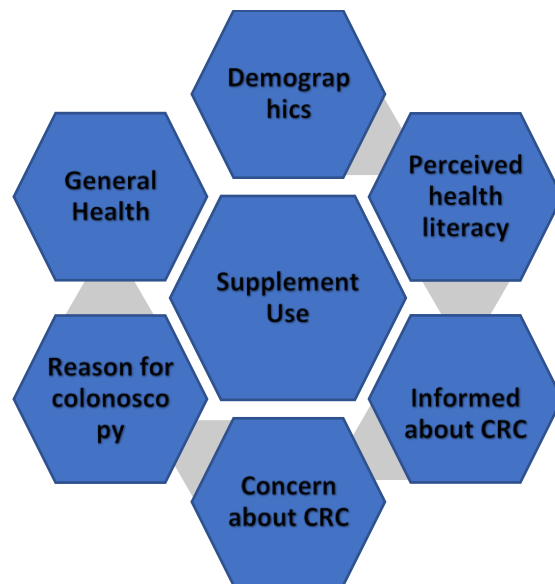


Figure 1: In regards to supplement use, there are several variables of interest that were analyzed to see if an association existed.

Cancer

Outranked by heart disease, cancer is the second leading cause of death in the United States, about half a million people die from cancer each year in the U.S (Center for Disease Control, 2017). Cancer involves the growth of abnormal cells that specifically affect a certain part of the body. However, these abnormal cells can metastasize to other parts of the body (American Cancer Society, 2015). If these abnormal cells are malignant, in a state of causing harm, then they can interrupt the body's normal routine in maintaining stable working systems, which can lead to a decrease in quality of life (American Cancer Society, 2015). The body can no longer perform the necessary functions to be operational so patients can no longer engage in the activities they usually do. Cancer not only affects the physical state but it also affects the emotional, mental, social, and behavioral states (Heydarnejad et al 2011). Consequently, cancer can affect all aspects of one's life and can completely change a patient's lifestyle. Although there are methods to treat cancer, chemotherapy and radiation being two of the most common, some methods have many negative side effects, such as hair loss and killing of healthy cells (American Cancer Society, 2015). Also, the cost of diagnosing and treating cancer is very high; surgical complications, hospital lengths of stay, and hospital readmissions, can increase overall health care costs (Silver, 2015). It might strain patient's financial means to cover the medical expenses that they will incur with dealing with cancer.

Currently, there are about seventeen major types of cancer; this proposal will focus on one specific cancer.

Colorectal Cancer

Colorectal Cancer (CRC) is cancer of the colon or rectum, located at the digestive tract's lower end (CDC, 2017). CRC is the third most common cause of death by cancer in both men and women in the U.S. (Parikh et al, 2014). In 2017, the American Cancer Society estimated that 135,430 people in the United States would be diagnosed with colorectal cancer. Along with high morbidity, CRC also has high mortality if diagnosed at later stages. In 2017, the American Cancer Society also estimated that 50,260 people in the United States would die from colorectal cancer, including 27,150 men and 23,110 women (American Cancer Society, 2017).

There are several identifiable trends in CRC with regard to race/ethnicity, gender, and age. In relation to race, CRC incidence and death rates are highest in Blacks and lowest in Asians/Pacific Islanders. Among males, during 2006 through 2010, the death rate in Blacks (29.4 per 100,000 population) was twice as high as the rate in Asians/Pacific Islanders (13.1) and higher than the rate of Non-Hispanic Whites (19.2) (Siegel et al, 2014). In regard to gender, men are more likely to develop CRC compared to women. About 1 or 2 out of every 100 men who are 60 years old today will get colorectal cancer by the age of 70 (CDC, 2015). The chance of developing CRC increases as age increases, with the majority of CRC cases diagnosed in individuals who are 60 years or older (Pusatcioglu and Braunschweig, 2011). However, there has been a new trend in CRC rates with respect to age; there has been a rise in the number of colorectal

cancer cases among the younger than 50 adult population in the U.S. While examining trends in CRC recent population based study, researchers found an increase in the incidence of CRC among young and middle aged adults. The study found an increase in CRC incidence from 1% to 2% in adults ages 20-39 and from 0.5% to 1% in adults ages 40-54 (American Cancer Society, 2017).

The incidence of CRC is decreasing and patients with CRC are living much longer now than before due to advances in screening and treatment methods (Tong et al, 2014). From 1975 to 2009, there has been a 45% drop in the CRC mortality rate. Although screening is leading to improvements, the number of people dying from CRC is still high, and health disparities in CRC screening and treatment are major issues that need more attention. Fortunately, there are certain actions that individuals can perform to prevent the development of CRC.

Colorectal Cancer Prevention

There are several behavioral strategies believed to reduce the risk of CRC, such as decreased tobacco and alcohol use, increased physical activity, and better eating habits, such as increasing fruit and vegetable intake (Chan and Giovannucci, 2010). More recently, evidence has suggested that supplement use may reduce risk of CRC (Hoffmeister et al, 2011, Wactawski et al, 2006; Pericleous et al, 2013, American Cancer Society, 2016).

Most well-known preventative strategies in decreasing CRC risk involves decreasing the use of tobacco and alcohol. Tobacco use has been reported to have a strong, consistent relationship with colorectal adenomas and carcinomas, which are

precursors to colon cancer. Tobacco usage has been linked to increased risk for colorectal adenoma in many epidemiologic studies, in individuals who have been smoking for a long period of time (Ji et al, 2006). Carcinogens in cigarette smoke may act to initiate tumors in the colon and rectum (Chao et al, 2000). Furthermore, risk is intensified and correlated with increasing number of cigarettes usually smoked, duration of cigarette use, and pack-years of use (Ji et al, 2006). Thus, a decrease in the use of tobacco would decrease the risk of developing these precursors and thus the probability of obtaining CRC.

Another factor in reducing risk of colon cancer is decreased alcohol usage. Alcohol consumption is a risk factor for cancers of the mouth, throat, colon, breast, and liver (CDC, 2016; Acott, 2008). In particular, moderate to heavy alcohol consumption has been shown to be a prominent factor in the early stages of CRC where carcinoma development occurs (Wang et al, 2015). This is a precursor lesion that indicates that a person is on the path of developing CRC. Therefore, drinking less can decrease the likelihood of developing these lesions and reduce the probability of developing CRC. Current users of both alcohol and tobacco were associated with a significantly younger age of colorectal cancer onset compared with all patients (Acott, 2008; Marley and Nan, 2014). Reducing tobacco and alcohol use can decrease the probability of developing CRC.

Another way to protect against the risk of acquiring CRC is an increased engagement in physical activity. Research has demonstrated that physical activity (PA) is correlated to CRC mortality, with about 15% of global CRC deaths being attributed to lack of physical activity (Sax et al, 2014). From previous studies, it is estimated that 12-

14% of colon cancer can be linked to lack of frequent engagement in vigorous and intense physical activity (Slattery, 2004). This is confirmed by a study from the UK in which researchers estimated that 12% of colorectal cancers could be prevented by individuals increasing the level of physical activity they perform (Anderson et al, 2014). Moreover, higher levels of PA in CRC survivors have been associated with a reduced risk of the disease recurrence (Sax et al, 2014). Physical activity can increase the life span of patients with CRC, allowing them to live longer and have the opportunity to engage in activities they wouldn't have otherwise be able to. Although it is understood that increased physical activity is linked with lower colon cancer risk, researchers are not sure of the amount, intensity and frequency of PA that is needed for a protective effect (Slattery, 2004).

Along with physical activity, diet has also been shown to reduce CRC risk. Researchers have found that eating healthier foods on a regular basis can improve health and decrease likelihood of having colon cancer. The consumption of fruits and vegetables, particularly dark yellow vegetables and apples, was found to provide a significant for a protective effect for CRC (Pusatcioglu & Braunschweig, 2011). Those who engage in healthy eating habits have a lower risk of developing CRC compared to those who do not. Studies have shown that the presence of colorectal adenomas and polyps, which are precursors to colorectal cancer, are associated with unhealthy diet patterns (Nomura et al, 2016). An unhealthy diet is high in calories, consumption of red meat or processed meat, and foods with a high glycemic index (carbohydrates, snack food, fried fast food, sugar-sweetened drinks, and sweets) (Pietrzyk, 2017). Therefore acquiring better eating habits would decrease the growth of these precursors and thus

reduce the probability of developing colon cancer. Although diet has been proven to reduce colorectal cancer risk, less is known about supplement use and its roles in decreasing CRC.

Supplement Use

People take supplements for various reasons: to acquire essential substances the body needs to operate properly to maintain or improve health and to help reduce the risk of disease (Food and Drug Administration, 2017). According to the National Health and Nutrition Examination Survey (NHANES) survey, among supplement users, multivitamins (MVS) were the most commonly used supplement (71%), followed by omega-3 or fish oil (33%), calcium (32%), vitamin D (32%), and vitamin C (32%) (Dickinson et al, 2014). In the United States the use of supplements is seen more in older Non-Hispanic White women, who tend to have higher education and income (Kantor et al, 2006). This is not surprising because higher education is correlated with higher income and higher income is correlated with better eating habits (Jasai et al, 2003). Blacks are inclined to use vitamin D at a rate higher than any other race because they tend to be vitamin D deficient (Harris, 2006). In a study among women who have had a colonoscopy, these women were more likely to engage in healthy behaviors, such as consuming less alcohol, eating more dietary fiber and using supplements, compared to women who have not had a colonoscopy (Zhang et al, 2005). The use of supplements was one strategy that has been found to be associated with colorectal cancer prevention

Supplement Use and Colorectal Cancer Prevention

There are several supplements that have been shown to lower a person's risk of obtaining CRC. Higher intake of both vitamin D and calcium separately has been found to be associated with lower colorectal cancer risk (Wactawski-Wende et al, 2006 and Pericleous et al, 2013). Individuals who were taking multivitamins (MVS) were less likely to develop colon cancer than were individuals who did not take multivitamins (Zhang et al, 2005). Several studies have shown that, aspirin and statins have protective a protective effect against the development of colorectal cancer (Hoffmeister et al, 2007, Algra et al, 2012, and Bibbins-Domingo, 2016 and U.S. Preventive Services Task Force, 2016). Although the mechanism of how supplements interact with the body is unknown, researchers have determined that there is an inverse relationship between supplements and colorectal cancer (Chan and Giovannucci, 2010, Heine-Broring et al, 2015). While we know of the benefits of supplement use and the impact on colorectal health, less is known about trends of supplemental use among a pre-colonoscopy population. Researchers are unsure of trends in the population in regard to age, gender, race/ethnicity, income and education. Identifying and understanding these trends can provide insight into developing interventions to increase supplement use among those groups with low uptake rates. It is important to determine if there are any health disparities among those who take supplements.

Chapter 3: Methods

Overview of Study

In the proposed work, I conducted secondary data analysis based on collected data of over 1800 pre-colonoscopy patients. The data were from a study regarding information on the pre-colonoscopy experience of individuals, such as how the colonoscopy came about, information seeking, beliefs and expectations, and levels of concern. The principal investigator of the research study was Dr. Barbara Curbow. I was not a part of the original research team, but I am conducting analysis of the original data to be included in my thesis paper. There has been several publications on the data collected, two include “Pathways to Colonoscopy in the South: Seeds of Health Disparities” (Curbow et al, 2015) and “It is just another test they want to do: Patient and caregiver understanding of the colonoscopy procedure” (King-Marshall et al, 2016). I received approval from the University of Maryland IRB to perform analysis on this data for my thesis paper (see appendix C).

Study Sample

Participants were recruited from patients who were scheduled for a colonoscopy at two academic-affiliated colonoscopy centers in Alachua County, Florida between September 2011 and October 2013. Eligible patients had to be able to read, write and comprehend English, and be cognitively able. Of the 3237 eligible patients, 737 of them were missed (22.8%) due to scheduling or patient flow issues. Of the remaining 2500 patients, 1841 (73.6%) agreed to participate in the study (Curbow et al, 2015 and King-Marshall et al, 2016)

Measurement

A self-administered survey that contained 40 questions and took approximately 15–20 minutes to complete was designed to provide information about the pre-colonoscopy experience, refer to appendix B. There were four sections to this survey, with each section aimed at collecting a particular set of information about the patient. Part 1 covered information about how the patients were doing and how they expected the procedure to go. Part 2 collected information about the participant themselves, such as health literacy and what actions they would take to deal with having cancer. Part 3 gathered specific information regarding who ordered the colonoscopy, why it was ordered and how it is being paid for. Part 4 asked about the patient's health, perceived stress, tobacco use and supplement use. In the interest of time and to reduce patient and health system burden, patient demographic data was collected by a similar survey that was administered to the enrolled caregiver, refer to appendix C.

Operationalization of Variables

Health Outcome

The health outcome, supplement use was assessed with a dichotomous variable (0=no and 1=yes). Participants marked whether they use any of the following every day or most days over the last six months: a. Multivitamin, b. Aspirin, c. Calcium, d. Vitamin C, e. Vitamin D, and h. Fish Oil. In relationship to supplement use, there are several variables of interest. The operational definition of each variable is explained below.

Demographic Variables

There are several demographic variables that might be related to supplement use; they are age, gender, race, income, and education. Age was a numeric response originally coded as a continuous variable but recoded for this analysis as 1= ages 18-49, 2=50-64 and 3= ages \geq 65 and gender is coded as 1=female and 2=male. Race was originally coded as follows: 1=American Indian/Alaskan Native, 2=Asian/Asian American, 3=Black/African American, 4=Native Hawaiian/Pacific Islander, 5=White/Caucasian and 6=Other but was recoded as follows for this analysis: 1=White/Caucasian, 2=Black/African American, 3= all others. Income was coded for this analysis as 1 = less than (LT) \$20,000, 2 = \$20,000 to \$49,999, 3 = \$50,000 to \$79,999, 4= greater than or equal to (GE) \$80,000. Education was recoded as 1 = less than high school (0-11yrs), 2 = high school/GED (12yrs), 3=any college (13-15yrs), 4=college graduate (16yrs), 5=graduate school (17yrs).

Perceived Health Literacy

Perceived health literacy was assessed using the BRIEF scale, which was adapted from the work of Chew, Bradley, and Boyko (2004) and Huan et al, (2009). The first item was ascertained by a Likert question: “how confident are you filling out medical forms by yourself?” (1=not at all to 5=extremely). The second item was ascertained by a Likert question: “how often do you have someone help you read medical materials?” (1=always to 5=never). The third item was ascertained similarly: “how often do you have problems learning about your medical condition because of difficulty understanding written information?” (1=always to 5=never). The fourth item was also ascertained similarly:

“how often do you feel you don’t understand what the doctors tell you?” (1=always to 5=never). The scale had good reliability (alpha = 0.75; mean inter-item correlation = 0.43). Perceived health literacy score was the sum of the response of the four questions (range 4-20) but was recoded as low (4–15), medium (16-19) and high (20) (King-Marshall et al, 2016). Informed about CRC was assessed on 1-5 Likert scale (1= not at all to 5= extremely) with the following question: “How informed about colon cancer and rectal cancer do you think you are?”

Concern about CRC and Reason for Colonoscopy

Concern about CRC was assessed on a 1–5 Likert scale (1 = not at all to 5 = extremely) with the following question: “how concerned are you about having colon or rectal cancer?” Reason for colonoscopy was assessed with the following question: “To the best of your knowledge, why was this colonoscopy ordered?” Responses were coded on a binary scale (1=yes and 2=no) with several response categories a. routine based on age, b. family history of colon cancer or rectal cancer, c. follow-up to a previous colonoscopy, d. follow-up to an abnormal test, and e. I have been having symptoms or problems.

General Health

Supplement use might be associated with general health. The health of the patient was measured in two separate ways. The first measurement of health dealt with the health status of the participant. The overall health of the participant was originally accessed on a 1-6 Likert scale (1=excellent to 6=very poor) with the following question: “Would you say that in general your health is?” but was recoded to a 1-3 scale (1=very good, 2=good

and 3=poor) (BRFSS [CDC], 1993). The second measurement of health dealt with the physical and mental health of the participant. Physical health was assessed by a numerical response option with the following question: “Thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?” (BRFSS [CDC], 1993) Mental health was also accessed by a numerical response option with the following question: “Thinking about your mental health, which includes stress, depression and problems with emotions, for how many days during the past 30 days was your mental health not good?” (BRFSS [CDC], 1993) After identifying the variables of interest, the data was cleaned.

Data Cleaning

In order to perform accurate data analysis, the data had to be cleaned. First, participants who did not answer supplement use questions (n=107) and participants who had age missing (n=7) were deleted from the analysis; some participants who did not answer supplement questions also had their age missing. Third, for individuals who had income missing, the data was left as missing. The final sample size (N) for the data after cleaning was 1756.

New Variables

Two new variables were created, any supplement, represented the use of any of the six supplements (multivitamin, calcium, vitamin C, vitamin D, fish oil and aspirin) by participants and protective supplement, which consists of supplements that have been shown to have a protective effect against CRC (Hoffmeister, 2007, Wactawski-Wende, 2006 and Pericleous et al, 2013, Algra et al, 2012, Lanas et al, 2017); it consists of

aspirin, calcium and vitamin D use summed together. This variable was created to see if this population was using supplements that research has shown can benefit them.

Analysis Plan

The analysis plan was outlined in Table 2. Secondary analysis using IBM SPSS © for Windows version 21.0 was used to determine if there are any significant associations between supplement use and demographic variables (race, age, income and education), perceived health literacy, informed about CRC, concern about CRC, reason for colonoscopy, and general health. There was several supplement use variables: type of supplement use (each individual supplement), any supplement (use of any supplement) and protective supplement (use of the 3 protective supplements). First, univariate analysis was performed on all variables to obtain frequencies, mean and standard deviation. Next, bivariate analysis was conducted to analyze each variable in regard to the supplement use categories. Third, an ANOVA or chi-square test was performed to determine the association, if any exist between the variables.

The first research question was to identify the rate of supplement use among this population and its association with different variables. Question 1.1 was to find the rates of supplement use (type of supplement use, any supplement use and protective supplement use). Question 1.2 was to determine if there is a relationship between demographic variables (age, gender, race, income, education) and all three supplement use variables. Question 1.3 was to determine if there is a relationship between perceived health literacy and informed about CRC and all three of the supplement use variables. Question 1.4 was to determine if there is a relationship between concern about CRC and

reason for colonoscopy and the three supplement use variables. A chi-square test was used to analyze categorical variables in regard to the three supplement use variables. An ANOVA test was used to analyze continuous variables in regard to the three supplement use variables.

The second research question was to compare general health and two of the supplement use variables (type of supplement uses and any supplement use). Question 2.1 was to determine if there is an association between health status and two out of the three supplement use variables. Question 2.2 was to determine if physical health was associated with two supplement use variables. Question 2.3 was to determine if mental health was associated with two supplement use variables. A chi-square test was used to analyze health status in regard to two supplement use variables because all variables are categorical. ANOVA was used to analyze physical health and mental health sick days in regard to the two supplement use variables since they are continuous variables.

Table 2: Analysis Plan

Research Question	Variable	Analysis 1 Type of Supplement Use (categorical)	Analysis 2 Any Supplement Use (categorical)	Analysis 3 Protective Supplement Use (categorical)	Statistical Test
1.1 What are the rates of supplement use?	N/A	✓	✓	✓	Frequencies/ Descriptive
1.2 Are demographic variables associated with supplement use?	Age (continuous)	✓	✓	✓	ANOVA
	Gender (categorical)	✓	✓	✓	Chi-square
	Race (categorical)	✓	✓	✓	Chi-square

Research Question	Variable	Analysis 1 Type of Supplement Use (categorical)	Analysis 2 Any Supplement Use (categorical)	Analysis 3 Protective Supplement Use (categorical)	Statistical Test
1.2 Are demographic variables associated with supplement use?	Income (categorical)	✓	✓	✓	Chi-square
	Education (categorical)	✓	✓	✓	Chi-square
1.3 Are perceived health literacy and informed about CRC associated with supplement use?	Health literacy (categorical)	✓	✓	✓	Chi-square
	Health Literacy (continuous)	✓	✓	✓	ANOVA
	Informed about CRC (categorical)	✓	✓	✓	Chi-square
1.4 Are concern about CRC and reason for colonoscopy associated with supplement use?	Concern about CRC (categorical)	✓	✓	✓	Chi-square
	Reason for colonoscopy (categorical)	✓	✓	✓	Chi-square
2.1 Is health status associated with supplement use?	Health status (categorical)	✓	✓		Chi-square
2.2 Is physical health associated with supplement use?	Physical health (continuous)	✓	✓		ANOVA
2.3 Is mental health associated with supplement use?	Mental Health (continuous)	✓	✓		ANOVA

Table 2: Describes the supplement use variable that each variable will be analyzed against and the statistical test that will be used.

Chapter 4: Results

Overview

Univariate analysis was conducted to determine the frequencies, mean and standard deviation of all variables, refer to table 3. Bivariate analysis was then performed between each variable and the supplement use categories: an ANOVA or chi-square test was done to determine if any association exist between any of the variables and supplement use. Afterwards, a post hoc test was conducted to determine where the difference lies within the different categories of variables that were found to be significant. Adjusted residuals with Excel were used as a post-hoc analysis of chi-square test of independence, with bonferroni corrections of the *P* values; the adjusted p value was calculated by dividing the original p value (0.05) by the number of comparisons.

The sample was predominantly White (77.3%), female (61.5%), and Non-Hispanic (87.4%). In regards to income, participants were distributed about evenly across the 4 income categories (range $\leq 10,000$ to $\geq 80,000$). The average education level was 14.2 years and the average age was 53.7 years, refer to Table 3.

Table 3: Frequencies of Variables

Demographics		
Variable	Category	1756 (%)
Race	White	1306 (77.3)
	Black/ African American	250 (14.8)
	Other	134 (7.9)
Age	18-49	467 (26.6)
	50-64	930 (53.0)

Variable	Categories	N (%)
Age	≥65	359 (20.4)
Gender	Female	1070 (61.5)
	Male	671 (38.5)
Income	<\$20,000	411 (26.9)
	\$20,000-49,999	419 (27.5)
	\$50,000-79,999	289 (18.9)
	≥\$80,000	408 (26.7)
Education	Less than High School (0-11yrs)	97 (6.0)
	High School/GED (12yrs)	441 (27.3)
	Some College (13-15yrs)	419 (25.7)
	College Graduate (16yrs)	242 (15.1)
	Graduate School (17yrs)	418 (25.9)
Perceived Health Literacy (Range 4-20)	Low (4-15)	456 (27.7)
	Medium (16-19)	837 (50.8)
	High (20)	355 (21.5)
Colorectal Cancer Variables		
Informed about CRC	Not at all/Slightly	466 (27.0)
	Moderately	651 (37.7)
	Quite a lot/Extremely	610 (35.3)
Concern about CRC	Not at all	347 (20.2)
	Slightly	530 (30.7)
	Moderately	454 (26.3)
	Quite a lot/Extremely	394 (22.8)
Reason for colonoscopy *these are not mutually exclusive	Routine based on age	806 (49.6)
	Family history of CRC	331 (20.7)
	Follow-up to previous colonoscopy	465 (28.9)
	Follow-up to an abnormal test	234 (14.9)
	I have been having symptoms or problems	625 (38.9)
Health Related Variables		

Variable	Categories	N (%)
Health Status	Very Good	821 (50.4)
	Good	572 (35.1)
	Poor	237 (14.5)
Physical Health (Mean/ Standard Deviation)	# of days not good	6.34±10.01
Mental Health (Mean/ Standard Deviation)	# days not good	5.19±9.12
Supplement Use *these are not mutually exclusive	Multivitamin	834 (48.4)
	Calcium	472 (27.9)
	Vitamin C	379 (22.7)
Variable	Categories	N (%)
Supplement Use	Vitamin D	575 (34.0)
	Fish Oil	398 (23.4)
	Aspirin	548 (32.4)
Any Supplement Use (Multivitamin, Aspirin, Calcium, Vitamin C, Vitamin D, Fish Oil)	Used none	517 (31.8)
	Used one	367 (22.5)
	Used two	247 (15.2)
	Used three or more	497 (30.5)
Protective Supplement Use (Aspirin, Calcium, vitamin, Vitamin D)	Use none	775 (47.0)
	Used one	416 (25.2)
	Used two	303 (18.4)
	Used three	155 (9.4)

Table 3: Univariate Analysis of variables that display the frequency, sample size, mean and standard deviation, along with the categories of each variable.

Rate of Supplement Use

As shown in Table 4, supplement use was categorized into three separate variables (type of supplement use, any supplement use and protective supplement use).

Type of supplement use was defined as the use of each of the six supplements listed

above. Multivitamins were used most often by participants (48%), followed by vitamin D (34%), aspirin (32%), calcium (27%), fish oil (23%) and vitamin C (22%). Any supplement use was defined as the use of none (31.8%) vs. one (22.5%) vs. two (15.2%) vs. three or more (30.5) of the six supplements. Similarly, protective supplement use was defined as the use of none vs. one vs. two vs. three of the protective supplements (calcium, aspirin and vitamin D). Among this population, 47.0% of supplement users took no protective supplements, 25.2% took one, 18.4% took two and 9.4% took three or more. A chi-square test or ANOVA was performed to examine the association between several variables and supplement use (type of supplement use, any supplement use and protective supplement use). An alpha level of 0.05 was used for both statistical tests.

Table 4: Supplement Use Analysis

<i>1.1 What is the rate of supplement use (type of supplement use, any supplement use and protective supplement use)?</i>								
	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
% yes	48.4	32.4	27.9	22.7	34.0	23.6	None: 31.8 One: 22.5 Two: 15.2 ≥3: 30.5	None: 47.0 One: 25.2 Two: 18.4 Three: 9.4

Table 4: Univariate Analysis of each type of supplement use, any supplement use and protective supplement use was conducted, frequencies provided.

Demographics

Age Categorical

For the purpose of this analysis, age was broken into three categories ages 18-49 (27%), 50-64 (53%) and 65 and older (20%), refer to Table 5.1. The relationship between age and type of supplement was significant. Older participants (62%) were more likely to use **multivitamins** $X^2(2, N=1723)= 38.70, p<.001$, compared to ages 50-64 (48%) and

ages 18-49 (40%). There were similar results for **aspirin** X^2 (2, N=1693)= 144.93, $p<.001$ and **calcium** X^2 (2, N=1689)= 46.47, $p<.001$. Older participants were more likely to use aspirin (54.3%) compared to those ages 50-64 (33.1%) and those ages 18-50 (14.2%). Older participants were also more likely to use calcium (40.1%) compared to those ages 50-64 (28.3%) and those ages 18-49 (18.2%). The results were the same for **vitamin C** X^2 (2, N=1671)= 12.37, $p=.02$, **vitamin D** X^2 (2, N=1690)= 55.05, $p<.001$ and **fish oil** X^2 (2, N=1685)= 74.97, $p<.001$. The oldest participants (ages 65 and older) were using these supplements more than the younger participants (ages 18-49 and 50-64), refer to Table 5.1

There was a significant association between age and **any supplement use** X^2 (6, N=1628)= 120.52, $p\leq.001$. The youngest participants were more likely to be using no supplements (44.6%) when compared to the older participants' ages 50-64 (32.1%) and ages 65 and older (13.2%). On the other hand, older participants were more likely to be using 3 or more supplements (49.4%) compared to younger participants ages 50-64 (29.4%) and ages 18-49 (19%). Similarly, there was a significant association between age and **protective supplement use** X^2 (6, N=1649)= 155.37, $p\leq.001$. Participants ages 18-49 were more likely to use no protective supplements (64.4%) compared to participants ages 50-64 (46.9%, $p<.001$) and ages 65 and older (23.8%, $p\leq.001$). Moreover ages 65+ were more likely to use at least 2 protective supplements (29.5%) compared to the other two groups (18-49- $p\leq.001$ and 50-64- $p<.001$). Similarly, participants 65 and older were also more likely to use three protective supplements (19.0%) compared to those ages 50-64 (9.7%, $p<.001$) and those ages 18-49 (1.8%, $p<.001$); adjusted alpha value is 0.004167.

Age continuous

Analysis using continuous age data (range: 18-87, mean and SD: 53.8± 12.8) showed similar trends. An analysis of variance showed a significant association between age continuous and type of supplement use: **multivitamin** $F(66, 1656) = 1.58, p = .002$, **aspirin** $F(66, 1626) = 4.02, p < .001$, **calcium** $F(67, 1621) = 1.71, p < .001$, **vitamin D** $F(67, 1622) = 1.79, p < .001$, and **fish oil** $F(67, 1617) = 1.98, p < .001$. However, age continuous was not significantly associated with vitamin C ($p = .195$). Older age was found to be significantly associated with increased **any supplement use** $F(3, 1624) = 47.36, p < .001$ and increased **protective supplement use** $F(66, 1582) = 3.48, p < .001$; refer to Table 5.1. Older participants were more likely to be using more supplements and also protective supplements.

Gender

A chi-square test of independence was performed to examine the relationship between gender and type of supplement use, refer to table 5.1. The relationship between these variables was significant for **calcium** $X^2(1, N=1679) = 73.39, p < .001$, **vitamin D** $X^2(1, N=1679) = 53.98, p < .001$ and **aspirin** $X^2(1, N=1681) = 17.71, p < .001$. Females were more likely to use calcium (35.2% vs. 15.9%) and vitamin D (40.6% vs. 23.1%) compared to males. However males (38.4%) were more likely than females (28.5%) to use aspirin. The relationships between gender and multivitamin ($p = .442$), vitamin C ($p = .383$), or fish oil ($p = .458$) were not significant. Females and males were equally likely to use these supplements.

Any supplement use was found to be associated with gender, $X^2(3, N=1691)= 38.70, (p=.004)$. Females are more likely to use three or more supplements (32.7%) compared to males (26.9%). Likewise, **protective supplement use** was found to be associated with gender, $X^2(3, N=1639)= 37.55, p<.001$. Females were more likely to be using two protective supplements (21.7%) compared to males (13.0%), refer to Table 5.1.

Race

For analysis purposes, race was condensed into three groups: Whites (77%), Blacks (15%) and others (8%). The relationship between race and five of the six supplements were significant as shown in table 5.1. Compared to Whites (49.6%) and other races (51.89%), Blacks (38.5%) were significantly less likely to use **multivitamin** $X^2(2, N=1660)= 11.12, p=.004$. The same was true for **calcium** $X^2(2, N=1631)= 18.68, p<.001$ and **fish oil** $X^2(2, N=1630)= 13.54, p=001$. Furthermore, Whites (33.6%) and Blacks (30.6%) were more likely to use **aspirin** $X^2(2, N=1636)= 6.38, p=.041$ compared to the other races (23.1%) [$p=0.035$ and $p=0.027$ respectively]. Additionally, Whites were more likely to consume **vitamin D** $X^2(2, N=1631)= 6.64, p=.036$ (35.3%), compared to Blacks (27.6) and other races (29.2%) ($p=0.024$ and $p=0.041$ respectively). On the other hand, there was no significant association between race and vitamin C ($p=.164$); refer to Table 5.1.

A significant association was found between **any supplement use** and race, $X^2(6, N=1575)= 17.06, p=.009$. Whites and other races were more likely to be using three or more supplements (32.8% and 29.6%) compared to Blacks (19.8%). A significant

association was also found between **protective supplement use** and race, $X^2(6, N=1594)= 15.0, p=.020$.

Table 5.1: Age, Gender and Race Analysis

<i>1.2 How is this rate associated with age, gender, race?</i>								
	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
Age categorical	<.001	<.001	<.001	0.002	<.001	<.001	<.001	<.001
18-49 % yes	39.7	14.2	18.2	19.3	25.3	12.2	None:44.6 One: 22.5 Two: 13.8 ≥3: 19.0	None:64.4 One: 17.8 Two: 16.0 Three: 1.8
50-64 % yes	47.8	33.1	28.3	21.8	32.4%	23.8	None: 2.1 One: 23.7 Two: 14.9 ≥3 :29.4	None:46.9 One: 26.7 Two: 16.7 Three: 9.7
65+ % yes	61.6	54.3	40.1	29.6	49.9	38.5	None:13.2 One: 19.6 Two: 17.8 ≥3: 49.4	None:23.8 One: 1.3 Two: 25.9 Three:19.0
Age continuous	.002	<.001	<.001	0.195	<.001	<.001	<.001	<.001
mean	55.5	59.7	57.4	55.9	57.3	58.8	None:49.0 One:52.5 Two: 5.39 ≥3: 58.01	None:49.4 One: 56.1 Two: 56.9 Three:61.4
Gender	0.442	<.001	<.001	0.383	<.001	0.458	.004	<.001
Female % yes	47.6	28.5	35.2	23.3	40.6	23.0	None:32.0 One: 19.8 Two: 15.5 ≥3: 32.7	None:44.6 One: 22.4 Two: 21.7 Three:11.3
Male % yes	49.5	38.4	15.9	21.5	23.1	24.5	None: 1.2 One: 27.0 Two: 14.9 ≥3: 26.9	None:51.0 One: 29.7 Two: 13.0 Three: 6.3
Race	0.004	0.041	<.001	0.164	0.036	0.001	.009	0.020
White % yes	49.6	33.6	29.8	22.9	35.3	25.7	None:30.7 One: 21.8 Two: 14.8 >3 : 32.8	None:45.2 One: 4.9 Two: 20.0 Three: 9.9
Black % yes	38.5	30.6	16.3	18.2	27.6	14.8	None:38.0 One: 25.3 Two: 16.9 ≥3 : 19.8	None:53.8 One: 27.1 Two: 12.5 Three: 6.7
Other % yes	51.9	23.1	29.2	26.0	29.2	22.7	None:29.6 One: 26.4 Two: 14.4 ≥3: 29.6	None:52.8 One: 26.0 Two: 13.4 Three: 7.9

Table 5.1: Bivariate analysis of supplement use by demographic variables (age, gender and race) was conducted, p values provided and percent of participants who selected yes.

Income

Income was condensed into four categories: <\$20K (27%), \$20K-49,999 (28%), 50K-79,999 (19%) and \geq 80K (26%) for the purpose of this analysis, refer to table 5.2. A chi-square test of independence was performed to examine the relationship between income and type of supplement use. A significant association was found between these variables. The relationship was significant for **calcium** X^2 (3, N=1476)= 21.12, $p<.001$; analysis showed that participants who had an income between \$50K-79,999 were more likely to use calcium (38.2%), compared to those who income was <\$20K (22.9%), between \$20K-49,999 (25.4%) or $>$ \$80K (28.6%). The results were very similar for **vitamin C** X^2 (3, N=1463)= 13.71, $p=.003$. Furthermore, the relationship was significant for **multivitamin** X^2 (3, N=1503)= 21.63, $p<.001$; those participants who had an income between \$50K-79,999 (57.2%) and participants who had an income \geq \$80K (51.5%) were more likely to use multivitamins, compared to those whose income was either between \$20K-49,999 (44.2%) or <\$20K (41.2%). Similar results were found for **fish oil** X^2 (3, N=1473)= 28.41, $p<.001$. Additionally, there was no significant association for aspirin ($p=.138$) or vitamin D ($p=.051$) with income; refer to Table 5.2

Regarding each income category, there was a significant association with **any supplement use** X^2 (9, N=1425)= 22.32, $p=.008$); those with higher income were more likely to be using three or more supplements (30.2%-37.0%) compared those with lower incomes (24.1%). Similarly, for each income category, there was a significant difference between the number of **protective supplements** that participants use X^2 (9, N=1441)= 21.08, $p=.012$. Participants in the highest income category ($>$ \$80K) were more likely to be using two protective supplements (21.0%) instead of three (8.1%). Those with either

an income between 50K and 79,999 were the least likely not to use supplements (40.1%) compared to those with an income <20K (52.8%), 20K-49,999 (47.7%) or >80K (48.3%).

Education

As seen in table 5.2, for the purpose of this analysis education was split into five categories: less than high school (0-11 yrs)-6.0%, high school/GED (12yrs)-27.0%, some college (13-15yrs)-26.0%, college graduate (16yrs)-15.0% and graduate school (17yrs)-26.0%). Analysis showed a significant association between education and type of supplement use. Compared to those who completed college or graduate school (16 or 17 years of school), participants who completed less than 16-17 years of school were less likely to use certain supplements: **multivitamins** $X^2(4, N=1589)= 13.99, p=.007$, **vitamin D** $X^2(4, N=1561)= 12.51, p=.014$, and **fish oil** $X^2(4, N=1560)= 11.05, p=.026$. However, there was no significant association between education and aspirin ($p=.639$), calcium ($p=.230$), or vitamin C ($p=.210$); refer to Table 5.2.

Furthermore, there was a significant association between education and **any supplement use** $X^2(9, N=1507)= 22.21, p=.035$. Participants with less education (grades 0=11yrs) were less likely to use three or more supplements (22.8%) compared to those who completed high school (28.6%), some college (30.6%), college (31.3%) and graduate school (33.3%). However, the association between education and protective supplement use ($p=.540$) was non-significant.

Table 5.2: Income and Education Analysis

<i>1.2 How is this rate associated with income and education?</i>								
	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
Income	<.001	0.138	<.001	0.003	0.051	<.001	.008	0.012
>20K % yes	41.2	31.1	22.9	20.1	28.3	16.2	None:38.1 One: 23.4 Two: 14.5 ≥3: 24.1	None:52.8 One: 23.3 Two: 5.4 Three: 8.6
20K-49,999 % yes	44.2	28.9	25.4	21.3	34.3	20.1	None:33.0 One: 23.5 Two: 13.3 ≥3 : 30.2	None: 47.4 One: 27.0 Two: 18.6 Three: 7.1
50K-79,999 % yes	57.2	37.2	38.2	30.9	38.1	30.9	None: 24.4 One: 21.0 Two: 17.6 ≥3: 37.0	None: 40.1 One: 25.8 Two: 19.9 Three: 14.2
≥80K % yes	51.5	31.0	28.6	20.2	34.0	28.4	None: 31.0 One: 20.6 Two: 16.9 ≥3: 31.5	None: 48.3 One: 22.6 Two: 21.0 Three: 8.1
Education	0.007	0.639	0.230	0.210	0.014	0.026	.035	0.540
Less than high school % yes	35.1	38.9	22.8	18.5	23.9	16.1	None:32.6 One: 20.7 Two: 23.9 ≥3: 22.8	None:46.7 One: 28.3 Two: 19.6 Three: 5.4
High School/ GED % yes	44.6	30.8	25.5	19.2	28.9	21.7	None:34.9 One: 25.2 Two: 11.3 ≥3: 28.6	None:51.3 One: 24.3 Two: 15.3 Three: 9.1
Some college % yes	47.3	32.2	27.5	21.6	36.8	21.3	None:32.5 One: 23.1 Two: 13.8 ≥3: 30.6	None: 6.3 One: 23.9 Two: 21.2 Three: 8.7
College graduate % yes	52.7	31.1	29.5	24.7	35.6	25.5	None:27.8 One: 24.7 Two: 16.3 ≥3: 31.3	None:45.5 One: 27.3 Two: 16.9 Three:10.4
Graduate school % yes	52.5	32.4	31.8	25.2	37.1	28.6	None:29.7 One: 18.9 Two: 18.1 ≥3: 33.3	None:44.7 One: 24.6 Two: 19.8 Three:10.9

Table 5.2: Bivariate Analysis of supplement use by demographic variables (income and education) was conducted, p values provided and percent of participants who selected yes.

Perceived Health Literacy

Categorical

For analysis purposes, perceived health literacy was condensed into three categories [low (4-14), medium (16-19) and high (20)], based on the combined score of four questions. There was no significant association between low, medium, or high perceived health literacy and supplement use. This was consistent for all three analyses (type of supplement use, any supplement use and protective supplement use); p values ranged from 0.162 to 0.660, refer to Table 7.

Continuous

As shown in Table 7, perceived health literacy continuous (range: 5-20, mean and SD:16.9±3.0) was only significantly associated with **multivitamin** $F(66, 1656) = 1.58$, $p = .002$. Participants with higher perceived health literacy were more likely to report using multivitamins. However, there was no significant association with the other supplements, any supplement use or protective supplement use (p values ranged from .061-.958).

Informed about CRC

Informed about CRC was further condensed into three categories [not at all/slightly (27%), moderately (38%), and quite a lot/extremely (35%)] for analysis purposes, refer to table 7. Being informed about CRC was significantly associated with each type of supplement: **multivitamin** $X^2(2, N = 1696) = 22.07$, $p < .001$, **calcium** $X^2(2, N = 1668) = 30.75$, $p < .00$, **vitamin C** $X^2(2, N = 1652) = 18.22$, $p < .001$, **vitamin D** $X^2(2,$

N= 1667)= 42.06, $p < .001$ and **fish oil** $X^2(2, N= 1666)=26.17, p < .001$. Those who were quite a lot/extremely or moderately informed about CRC were more likely to use these supplements compared to those were not at all/slightly informed about CRC or less informed about CRC. However, aspirin use did not have a significant association with being informed about CRC ($p = .485$), refer to Table 6.

Any supplement use was found to be associated with being informed about CRC $X^2(6, N=1609)= 39.47, p < .001$. There was no difference between the groups with those using one or two supplements. However, those who were quite a lot/extremely (36.7%) or moderately (31.5%) informed about were more likely to be using 3 or more supplements compared to those who were not at all/slightly (21.1%) informed about CRC. Similarly, **protective supplement use** was also shown to be significantly associated with being informed about CRC $X^2(6, N=1629)= 46.85, p < .001$. There was no difference among the groups with those using one or at least three protective supplements. However, those who were quite a lot/extremely informed about CRC (25.7%) were more likely use two protective supplements, compared to those who were not at all/slightly informed about CRC (11.6%) and those moderately informed about CRC (16.6%).

Table 6: Perceived Health Literacy and Informed about CRC Analysis

<i>1.3 How is this rate associated with perceived health literacy and informed about CRC?</i>								
	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
Perceived Health Literacy categorical	0.162	0.261	0.455	0.481	0.202	0.292	.349	0.660
Low (4-15) % yes	45.0	35.2	26.2	21.9	31.0	22.2	None:30.0 One: 26.3 Two: 13.7 ≥3:30.0	None:45.7 One: 27.9 Two: 17.6 Three: 8.8

	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
Medium (16-19) % yes	48.8	31.1	29.1	24.2	35.7	24.1	None:32.1 One: 21.4 Two: 15.0 ≥3: 31.5	None:47.8 One: 22.9 Two: 19.4 Three: 9.9
High (20) % yes	51.7	30.7	29.9	21.3	35.8	27.1	None:33.4 One: 18.9 Two: 16.1 ≥3: 31.6	None:46.1 One: 25.8 Two: 18.8 Three: 9.4
Perceived Health Literacy continuous	0.003	0.748	0.367	0.802	0.183	0.577	.113	0.564
mean	17.1	16.6	17.0	16.9	17.1	17.0	None:16.9 One: 16.5 Two:16.9 ≥3:16.93	None:16.9 One: 16.5 Two: 17.0 Three:16.9
Informed about CRC	<.001	0.485	<.001	<.001	<.001	<.001	<.001	<.001
Not at all/slightly % yes	39.4	31.0	19.0	16.0	23.6	15.4	None:39.4 One: 26.1 Two: 13.3 ≥3:21.1	None:55.5 One: 26.1 Two: 11.6 Three: 6.8
Moderately % yes	49.3	31.3	28.3	23.2	32.7	24.7	None:31.7 One: 21.5 Two: 15.3 ≥3:31.5	None:48.2 One: 25.2 Two: 16.6 Three:10.1
Quite a lot/ extremely % yes	53.8	34.0	34.6	27.1	42.7	28.8	None:25.9 One:20.8 Two: 16.6 ≥3:36.7	None:39.6 One: 24.1 Two: 25.7 Three:10.6

Table 6: Bivariate Analysis of supplement use by perceived health literacy and Informed about CRC was conducted, p values provided and percent of participants who selected yes.

Concern about CRC

Being concern about CRC was only found to be associated with **aspirin** X^2 (3, N=1669)= 15.25, p=.002. Participants who were quite a lot/extremely (35.9%) or moderately (37.2%) were more likely to use aspirin, compared to those who were slightly (28.8%) or not at all (26.4%) informed about CRC. On the other hand, there was no association between concern about CRC and multivitamin (p=.687), calcium (p=.484), vitamin C (p=.055), vitamin D (p=.202), or fish oil (p=.224). Similarly, there was no association between concern about CRC and any supplement use (p=.059) or protective supplement use (p=.154), refer to Table 7.

Table 7: Concern about CRC Analysis

<i>1.4 How is this rate associated with concern about CRC?</i>								
	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
Concern about CRC	0.687	0.002	0.484	0.055	0.202	0.224	.059	0.154
Not at all % yes	48.8	26.4	29.6	25.2	35.2	23.3	None:34.7 One: 19.1 Two: 17.2 ≥3:291	None:50.9 One: 22.2 Two: 17.0 Three: 9.9
Slightly % yes	46.6	28.8	25.4	18.4	30.4	21.6	None:33.8 One: 25.7 Two: 15.1 ≥3:255	None:51.2 One: 25.1 Two: 16.1 Three: 7.6
Moderately % yes	50.3	37.2	29.0	24.8	33.9	27.2	None:28.4 One: 23.0 Two: 14.3 ≥3:343	None:43.6 One: 26.5 Two: 19.5 Three:104
Quite a lot/ Extremely % yes	48.1	35.9	28.5	23.1	36.9	22.8	None:30.5 One: 20.5 Two: 15.1 ≥3:338	None:42.8 One: 25.7 Two: 21.4 Three:10.2

Table 7: Bivariate Analysis of supplement use by concern about CRC was conducted, p values provided and percent of participants who selected yes.

Reason for Colonoscopy

Participants answered a series of yes/no statements related to their perceived reasons for their current colonoscopy. The reasons included routine based on age (49.6%), family history of CRC (20.7%), follow-up to an abnormal test (14.9%), follow-up to previous colonoscopy (28.9%) and patient reported symptoms and problems (38.9%). The response options were not mutually exclusive; therefore participants may have selected more than one reason for why the colonoscopy was ordered.

Routine based on age

The association between routine based on age and type of supplement use was significant for **aspirin** $X^2(1, N= 1579)= 27.21, p<.001$ and **fish oil** $X^2(1, N= 1573)= 4.64, p=.031$. Those who were not there for routine screening based on age were more

likely to be using aspirin and fish oil. However, there was no significant association was for multivitamin ($p=.060$), calcium ($p=.141$), vitamin C ($p=.654$) or vitamin D ($p=.369$).

Likewise, there was no significant association between routine based on age and any supplement use ($p=.481$). However, there was a significant association with **protective supplement use** $X^2(3, N= 1543)= 13.06, p=.005$. Participants who reported routine based on age as the reason for the colonoscopy were using less protective supplements; 45.6% used no protective supplements compared to those using one (26.2%) or two (17.0%) or three (11.2%), refer to Table 8.

Family history of CRC

Chi-square analysis showed no association between family history of CRC and each type of supplement use, except for **calcium** $X^2(1, N=1554)= 4.42, p=.036$. Of those who selected family history of CRC, 31.5 % used calcium compared to 68.5% who did not use calcium. There were no significant association with any supplement use ($p=.913$) or protective supplement use ($p=.085$), refer to Table 8.

Follow-up to previous colonoscopy

The association between follow-up to a previous colonoscopy and type of supplement use is significant: **multivitamin** $X^2(1, N= 1589)= 8.79, p=.003$, **aspirin** $X^2(1, N= 1568)= 10.19, p=.001$, **calcium** $X^2(1, N= 1567)= 14.71, p<.001$, **vitamin D** $X^2(1, N= 1568)= 22.16, p<.001$ and **fish oil** $X^2(1, N= 1569)= 15.79, p<.001$. For those who selected follow-up to previous colonoscopy, they were more likely to have used the supplements listed above, compared to those who did not select this option. Moreover, the relationship was not significant for vitamin C ($p=.183$).

Additional analysis showed a significant association between follow-up to a previous colonoscopy and **any supplement use** $X^2(3, N=1520)= 25.62, p<.001$. Participants who selected follow-up to previous colonoscopy were more likely to use three supplements (38.7%) compared to those who did not select this option (26.3%). Likewise, there is a significant association with **protective supplement use** $X^2(3, N=1539)= 28.55, p<.001$. Participants who selected follow-up to previous colonoscopy were more likely to use two protective supplements (24.4%) compared to those who did not select this option (16.4%).

Follow-up to an abnormal test

As shown in table 8, the association between follow-up to an abnormal test and supplement use analyses was not significant. The association between follow-up to an abnormal test and type of supplement use was non-significant for multivitamin ($p=.809$), aspirin ($p=.747$), calcium ($p=.339$), vitamin C ($p=.556$), vitamin D ($p=.683$), or fish oil ($p=.486$). Likewise, additional analysis showed no significant association with any supplement use ($p=.540$) or protective supplement use ($p=.575$); refer to Table 8.

I have been having symptoms or problems

The association between having symptoms or problems and type of supplement use is significant for **aspirin** $X^2(1, N=1564)= 30.54, p<.001$. Those who were there because they were having symptoms were less likely to use aspirin (23.3%) compared to those not there because they were having symptoms (36.6%). However, the association was not significant for multivitamin ($p=.359$), calcium ($p=.302$), vitamin C ($p=.602$), vitamin D ($p=.857$), or fish oil ($p=.055$); refer to Table 8.

Additional analysis showed a significant association between a person having symptoms or problems and both **any supplement use** $X^2(3, N= 1519)= 8.29, p<.001$ and **protective supplement use** $X^2(3, N= 1539)= 18.92, p<.001$. Participants were less likely to have used supplements; 35.7% used none, 21.2% used one, 15.6% used two, and 27.6% use three or more. Likewise, participants were also less likely to have used protective supplements; 52.9% used none, 22.0% use one, 18.8% used two and 6.2% use three or more.

Table 8: Reason for Colonoscopy Analysis

<i>1.4 How is this rate associated with reason for colonoscopy?</i>								
Reason for colonoscopy	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
Routine based on age	0.064	<.001	0.141	0.654	0.369	0.031	.481	0.005
% yes	50.3	38.1	29.0	21.9	31.9	25.1	None: 29.6 One: 23.6 Two: 16.1 ≥3:30.8	None: 45.6 One: 26.2 Two: 17.0 Three: 6.4
Family history of CRC	0.578	0.483	0.036	0.295	0.052	0.150	.913	0.085
% yes	45.9	32.9	31.5	24.1	37.3	19.4	None:29.9 One: 23.2 Two: 16.6 ≥3:30.3	None:44.0 One: 23.3 Two: 22.3 Three: 8.1
Follow-up to previous colonoscopy	0.003	0.001	<.001	0.183	<.001	<.001	<.001	<.001
% yes	53.6	37.4	33.9	24.3	41.7	29.7	None:24.9 One: 22.6 Two: 13.8 ≥3:38.7	None:37.4 One: 26.9 Two: 24.4 Three:11.2
Follow-up to an abnormal test	0.809	0.747	0.339	0.556	0.683	0.486	.540	0.575
% yes	47.0	30.4	24.2	20.5	31.3	24.3	None:33.6 One: 21.7 Two: 13.3 ≥3:31.4	None:48.2 One: 25.7 Two: 19.9 Three: 6.2
Having symptoms or problems	0.359	<.001	0.302	0.602	0.857	0.055	.040	<.001

Having symptoms or problems	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
% yes	46.1	23.3	25.7	22.8	32.5	19.9	None:35.7 One: 21.2 Two: 15.6 ≥3:27.6	None: 52.9 One: 22.0 Two: 18.8 Three: 6.2

Table 8: Bivariate analysis of supplement use by the five reasons for the colonoscopy was conducted, p values provided and percent of participants who selected yes.

General Health

Health Status

For the purpose of this analysis, health status was condensed in three categories: very good (50.4%), good (35.1%) and poor (14.5%), refer to Table 9. Only **multivitamin** had a significant association with health status $X^2(2, N=1602)=6.14, p=.047$. Those who had very good (50.2%) or good (47.6%) health status were more likely to use multivitamins than those with a poor health status (41.0%). The analysis did not show any significant association between health status and the other supplements; aspirin, calcium, vitamin C, vitamin D or fish oil; p values ranged from .080-.761). Similarly, there was no significant association between health status and any supplement use (p=.447).

Table 9: Health Status Analysis

<i>2.1 How is health status associated with supplement use?</i>								
	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
Health Status	0.047	0.558	0.093	0.359	0.761	0.080	.447	N/A
Very Good % yes	50.2	31.0	29.9	22.3	33.6	24.4	None: 32.2 One: 22.3 Two: 16.0 ≥3: 29.5	N/A

	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
Good % yes	47.6	33.6	27.5	24.3	35.3	22.9	None: 30.8 One: 21.7 Two: 14.6 ≥3: 32.9	N/A
Poor % yes	41.0	33.2	22.6	19.7	33.2	17.3	None: 34.5 One: 26.1 Two: 13.3 ≥3: 26.1	N/A

Table 9: Bivariate analysis of supplement use by health status was conducted, p values provided and percent of participants who selected yes.

Physical Health

Participants were asked the number of days their physical health was not good, this ranged from 0-30 days and the mean was 6.34. Physical health was only significantly associated with **multivitamin** use $F(31, 1636) = 1.64, p = .015$, refer to Table 10.

Participants who did not use multivitamins had a greater mean number of days that their physical health was not good. However, physical health was not found to be associated with any supplement use, p values ranged from 6.08-7.46, refer to table 10.

Table 10: Physical Health Analysis

2.2 How is physical health associated with supplement use?								
	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
Physical Health	0.015	0.117	0.314	0.554	0.833	0.156	.051	N/A
mean	5.5	5.9	5.4	6.6	6.3	5.0	None: 7.46 One: 6.08 Two: 5.42 ≥3: 6.42	N/A

Table 10: Bivariate analysis of supplement use by physical health was conducted, p values provided and percent of participants who selected yes

Mental Health

Participants were asked the number of days their mental health was not good, this ranged from 0-30 days and the mean was 5.19. There was no significant association

between mental health and any individual supplement. This held true for any supplement use, p values ranged from 0.085-0.885, refer to table 11.

Table 11: Mental Health Analysis

<i>2.3 How is mental health associated with supplement use?</i>								
	Type of Supplement Use						Any Supplement Use	Protective Supplement Use
	Multivitamin	Aspirin	Calcium	Vitamin C	Vitamin D	Fish Oil		
Mental Health	0.349	0.085	0.885	0.590	0.521	0.605	.136	N/A
mean	4.5	4.6	5.0	5.2	5.7	4.3	None: 6.11 One: 4.56 Two: 4.69 Three or more: 5.40	N/A

Table 11: Bivariate analysis of supplement use by mental health, p values were provided and percent of participants who selected yes

Chapter 5: Discussion

Summary of Central Finding

The purpose of this paper was to determine if any associations exist between supplement use and several variables of interest. Supplement use was defined in three ways: type of supplement use, any supplement use and protective supplement use. Two research questions pertaining to supplement use were examined: (1) Among a group of pre-colonoscopy individuals, how do rates of supplement use differ by various demographic and conceptual characteristics? and (2) Among a group of pre-colonoscopy individuals, is general health associated with supplement use? The simple answer to each question is yes- demographic and conceptual characteristics are associated with supplement use. The data showed that older participants, females, Whites, those with higher income and education were more likely to use supplements. These results were similar to the national statistics (NHANES 30124) in the general population (CDC, 2016). Similarly, informed about CRC and reason for colonoscopy were found to be significant with supplement use. The variables that were most significant with supplement use were the demographic variables and informed about CRC.

Previous research has similarly found age to be associated with supplement use, with the older population (age 60 and older) being more likely to use supplements (Gahche et al, 2017). This was consistent with the findings of the present study, as those 65 and older were more likely to use supplements compared to those ages 18-49 and those ages 50-64. A longitudinal study investigating supplement use among a Japanese population showed that females were more likely than males to use supplements (Imai et

al, 2015). This was consistent with the finding in this paper that demonstrated that gender was associated with supplement use, with females using supplements more than males. Similarly, race was found to be associated with supplement use; whites and other races were more likely to use certain supplements compared to Blacks. This was illustrated in a study among an urban African American and White population which showed that Whites used calcium, magnesium, niacin, and riboflavin more than their African American counterparts (Stave, 2015). Similarly, other races use certain supplements, such as vitamin A, vitamin B and magnesium, more than Blacks (Blumberg, 2017). The relationship between income and supplement was supported, in a study (Whiting, et al, 2010) which demonstrated that lower income individuals were less likely to use supplements. Among a study evaluating supplement use among Black and Whites, results illustrated that that participants who had literacy of college level or higher were more likely to use supplements (Stave, 2015). This was consistent with findings of this analysis that showed that participants with high education (college graduate or graduate school) were more likely to use supplements compared to those with low education (less than high school, some high school and some college). In addition to demographic factors, the results showed that being informed about CRC was significantly associated with supplement use. Those who were informed about CRC were more likely to be using supplements.

However, reason for colonoscopy, concern about CRC and perceived health literacy were not associated with supplement use. To my knowledge, there have not been prior studies examining why a colonoscopy was ordered and its association with supplement use. Similarly, there were no studies that investigated concern about CRC

and perceived health literacy and their relationship with supplement use. General health was not found to be associated with supplement use; this was interesting since studies have shown that supplement use was associated with living a healthier life, decreasing smoking and alcohol use, having a healthy diet and exercising often (Hoggatt, 2003, Bailey et al, 2007).

Implication of Findings

The results pertaining to demographics among this population were similar to those found in the literature (Council for Responsible Nutrition, 2012). The data shows that among supplement users, white women with high education and income are more likely to use supplements compared to other groups. Therefore other groups, such as the younger population, males, minorities, and those with lower education and income, are missing out on the potential benefits they could acquire from taking supplements (ODS, 2018). Despite the health benefits that supplements can produce, disparities exist in supplement use; populations may have barriers that prevent them from using supplements or there might be a lack of awareness about supplements among these subgroups. Researchers must first determine if these subpopulations are obtaining the proper nutrients and if they are not, then they must identify the reasons why. Moreover, for those sub populations that are taking supplements, it is crucial that these individuals are not over consuming (Data and Vitolins, 2016).

It was interesting to see that those individuals who have had a previous colonoscopy were less likely to be using all supplements except (vitamin C) compared to those who were not there for a previous colonoscopy. Screening events can be a great opportunity for health professionals to recommend supplement use to their patient as a

method to reduce their risk of CRC. Health providers can explain how supplements should be used and the potential benefits they can receive from using supplements, if they are a good candidate. This highlights the importance for more awareness about prevention strategies and the role that health care providers play in providing beneficial information to their patient.

Limitations and Strengths

There were several limitations of this study. First, geographic diversity did not exist since participants were recruited from rural-suburban areas and both sites were academic affiliated so there was no representation from urban patients or private practices. Second, there was a lack of racial diversity, most participants were either White or Black; there is lack of representation from other racial groups such as Asians and Native Americans. Third, the survey used did not have specific questions pertaining to supplement use, such as how long they had been taking the supplement (s) and what prompted them to begin using the supplement(s). However, these limitations are balanced by several strengths. First, this paper is a strong contribution to the scientific literature in a new area. There are few studies on supplement use among this population; this paper highlights potential factors that are associated with supplement use. Second, the survey allowed for the development of two research questions, with several sub questions that were analyzed rigorously by chi-square and t-test. Third, the study had a high response rate. The higher the response rate of a survey, the lower the risk of having non-response bias. Lastly, the study had a relatively large sample size (N=1756). This creates a narrower margin of error: the chance that the confidence interval (margin of error around the estimate) will contain the true value that you are trying to estimate. A large sample

size also increases the power of the statistical significance test and the decreases the probability of making a Type II error (incorrectly retaining a false null hypothesis). The findings are suggestive for future research and potential interventions.

Directions for future Research

Supplement use among this population was varied by several characteristics/qualities. Similar to previous findings (Jasti et al, 2003) results showed that disparities exist in supplement use. Future research should focus on explaining why these disparities exist. Researchers need to (1) conduct a study to identify groups using and not using supplements; (2) identify facilitating factors and barriers to the utilization of supplement and (3) develop interventions where people can overcome those barriers and have equal opportunity for utilization.

First there needs to be an assessment of those using and those not using supplements. This will help us to determine which populations we need to target to increase knowledge and awareness of supplements use. It is also important to understand which groups are taking supplements and the underlying reasons why. This can help use to understand why disparities exist in supplement use. Has supplement use been recommended to these groups by a health care provider? Furthermore, some individuals maybe taking supplements without the advice of their health provider; there can be negative side effects if they are taking medications or have a medical problem (ODS, 2017). It is also essential to identify groups that are not taking supplements because there are potential benefits they can receive from using supplements, if they are a good candidate. After identifying groups that use and do not use supplements, it is crucial to understand the reasons why.

Second, future research needs to focus on factors that facilitate or hinder the use of supplements among these populations. A large percent of the American population use supplements, but we need to understand the motivation to use these supplements and the channels that allow them access. However, there are sub-populations that do not use supplements. It is crucial that researchers investigate the barriers that prevent the use of supplements among these populations. Moreover, supplement use cannot be analyzed in a vacuum because it is just one of many strategies people utilize to improve their health and wellness (Dickinson, 2012).

Third, for the supplements that are effective, how can we persuade those not using them to consume them? One solution is to get researchers to develop interventions. Tailored interventions can be designed among the populations that are not using supplements; these interventions can address the underlying reasons why people do not use supplements and the barriers they face. These interventions can increase awareness of supplements and knowledge of how and why supplements should be used.

Overall, the study findings suggest further research is needed to better understand the associations identified between the variables of interest and supplement use. Once researchers more fully understand the relationship between these variables, the findings can be used to develop, implement, and evaluate targeted interventions. Overall, these findings are a step towards a better understanding of supplement use among this pre-colonoscopy population.

Conclusion

Supplements have been shown to produce several health benefits and should be further investigated to confirm those health benefits. This study was a strong contribution

to the scientific literature regarding supplement use. Supplement use was found to be associated with demographic factors (age, gender, race, income and education) and being informed about CRC. However, supplement use was not found to be associated with perceived health literacy, concern about CRC and general health. The findings suggest that there are disparities in supplement use, which is consistent with the literature (Jasti et al, 2003; Foote, 2003; Blumberg, 2017; Stave, 2015; Whiting, 2017). Researchers need to focus on understanding the underlying factors that create disparities in supplement use among certain populations. There also needs to be more awareness and education about supplements, so individuals are obtaining proper amount of nutrients. Lastly, it is important to get health care providers involved in the process, they are a vital part of health promotion and can determine if an individual is a good candidate for supplement use.

Appendices

A. Table 12: Recoding of Variables

Variable	Original 1756 (%)		Recode 1756 (%)	
Race	1=American Indian/ Alaskan Native	21 (1.3)	1=White	1306 (77.3)
	2=Asian/Asian American	43 (2.5)		
	3=Black/African American	250 (14.8)	2=Black/ African American	250 (14.8)
	4=Native Hawaiian/ Pacific Islander	0 (0)		
	5=White/Caucasian	1306 (77.3)	3=Other	134 (7.9)
	6=Other	70 (4.1)		
Age	53.8 (±12.8)		1=18-49	467 (26.6)
			2=50-64	930 (53.0)
			3=≥65	359 (20.4)
Gender	1=female	1070 (61.5)	None	
	2=male	671 (38.5)		
Income	1≤\$10,000	225 (14.7)	1≤\$20,000	411 (26.9)
	2=\$10,000-19,999	186 (12.2)	2=\$20,000-49,999	419 (27.5)
	3=\$20,000-29,999	157 (10.3)	3=\$50,000-79,999	289 (18.9)
	4=\$30,000-39,999	149 (9.8)	4=≥\$80,000	408 (26.7)
	5=\$40,000-49,999	113 (7.4)		
	6=\$50,000-59,999	107 (7.0)		
	7=\$60,000-69,999	101 (6.6)		
	8=\$70,000-79,999	81 (5.3)		
	9=≥\$80,000	408 (26.7)		
Perceived Health Literacy (Range: 4- 20)	16.9±3.0		Low (4-15)	456 (27.7)
			Medium (15-19)	837 (50.8)
			High (20)	355 (21.5)

Education	14.2±2.3		1= Less than High School (0-11yrs)	97 (6.0)
			2= High School Graduate/GED (12yrs)	441 (27.3)
			3= Some College(13-15yrs)	419 (25.9)
			4= College Graduate (16yrs)	242 (15.1)
			5= Graduate School (17yrs)	418 (25.9)
Informed about CRC	Not at all	136 (7.9)	Not at all/ slightly	466 (27.0)
	Slightly	330 (19.10)		
	Moderately	651 (37.7)	Moderately	651 (37.7)
	Quite a lot	433 (25.1)		
	Extremely	177 (10.2)	Quite a lot/ Extremely	610 (35.3)
Concern about CRC	Not at all	347 (20.1)	Not at all	347 (20.1)
	Slightly	530 (30.7)	Slightly	530 (30.7)
	Moderately	454 (26.3)	Moderately	454 (26.3)
	Quite a lot	226 (13.1)	Quite a lot/ Extremely	394 (22.8)
	Extremely	168 (9.7)		
Reason for Colonoscopy *these are not mutually exclusive	Routine based on age	806 (49.6)	None	
	Family history of colon or rectal cancer	331 (20.7)		
	Follow-up to previous colonoscopy	465 (28.9)		
	Follow-up to an abnormal test	234 (14.9)		
	I have been having symptoms or problems	625 (38.9)		
Health Status	1=Excellent	273(16.8)	1=Excellent +Very Good→ Very Good	821 (50.4)
	2=Very Good	548 (33.6)		
	3=Good	572 (35.1)	2=Good→ Good	572 (35.1)

	4=Fair	183 (11.2)		
	5=Poor	51 (3.1)	3=Fair+ Poor+ Very Poor→ Poor	237 (14.5)
	6=Very Poor	3 (0.2)		
Physical Health	6.34±10.01		None	
Mental Health	5.19±9.12		None	
Supplement Use *these are not mutually exclusive	Multivitamins	834 (48.4)	Use none	517 (31.8)
	Calcium	472 (27.9)	Use one	367 (22.5)
	Vitamin C	379 (22.7)	Use two	247 (15.2)
	Vitamin D	575 (34.0)	Use three or more	497 (30.5)
	Fish Oil	398 (23.36)		
	Aspirin	548 (32.4)		
Protective Supplement Use (Aspirin, Calcium, Vitamin D)	N/A		Used none	775 (47.0)
			Used one	416 (25.2)
			Used two	303 (18.4)
			Used all three	155 (9.4)

Table 12: This table shows how variables were recoded for analysis purposes.

B. Pre-colonoscopy Survey

Study ID: PT__/_ __ __

University of Florida

PART 1: HOW YOU ARE DOING TODAY

Pre-Colonoscopy Survey -- Patient Version

1. Would you say that in general your **health** is: (*check one box only*)
¹ Excellent ² Very Good ³ Good ⁴ Fair ⁵ Poor ⁶ Very poor

2. On a scale of 1 to 10, how **anxious** are you feeling **TODAY?** (*circle one number*)
Not at all anxious 1 2 3 4 5 6 7 8 9 10 **Very Anxious**

3. Did any of the following cause **problems** for you in getting the colonoscopy?

a. Getting an appointment	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
b. Getting time off work	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
c. Finding someone to come with you	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
d. Getting a ride	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
e. My driver getting time off work	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
f. How much it costs	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
g. Arranging child or elder care	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
h. Other (What? _____)	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no

4. Before today, have you had any of the following communications about your colonoscopy?

a. Talked to the doctor doing the colonoscopy in person	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
b. Talked to the doctor doing the colonoscopy by phone	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
c. Talked to a nurse from the colonoscopy center in person	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
d. Talked to a nurse from the colonoscopy center by phone	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
e. Received materials by mail from the colonoscopy center	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
f. Other (what? _____)	

5. **How** do you think you will get the **results** from your colonoscopy?

a. Doctor doing the colonoscopy will tell me right afterwards	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
b. Doctor doing the colonoscopy will telephone me	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
c. Nurse from the colonoscopy center will tell me right afterwards	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
d. Nurse from the colonoscopy center will telephone me	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
e. I will get a printed report right afterwards	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
f. I will get a letter in the mail from the colonoscopy center	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
g. My personal doctor will tell me	<input type="checkbox"/> ¹ yes <input type="checkbox"/> ² no
h. Other (how? _____)	

6. How would you **MOST LIKE** to get your results?

7. What do you **expect** the results of the colonoscopy will show?

8. About how many minutes do you **think** the doctor **will** spend with you **BEFORE** your colonoscopy?
_____ minutes

9. About how many minutes do you **think** the doctor **will** spend with you **AFTER your** colonoscopy?
 _____minutes

10. How much **benefit** (help) to your health is having a colonoscopy? (*circle one number*)
No benefit at all 1 2 3 4 5 6 7 8 9 10 **Very high benefit**

11. How much **risk** (possible harm) to your health is having a colonoscopy? (*circle one number*)
No risk at all 1 2 3 4 5 6 7 8 9 10 **Very high risk**

12. In making your decision to have a colonoscopy, how much did you **compare the benefits and risks**?
 (*circle one number*)
Not at all 1 2 3 4 5 6 7 8 9 10 **A great deal**

13. Please *circle the number* for how much you *agree or disagree* with the following statements:

1=strongly agree	2=agree	3=neither/neutral	4=disagree	5=strongly disagree			
			strongly agree	agree	neither/neutral	disagree	strongly disagree
a. The decision to have a colonoscopy was hard to make.	1	2	3	4	5		
b. I am satisfied with my decision to have a colonoscopy.	1	2	3	4	5		
c. I felt pressure from other people to have a colonoscopy.	1	2	3	4	5		
d. The decision to have a colonoscopy was largely my own .	1	2	3	4	5		

14. How **informed** about colonoscopy do you think you are?
¹ Not at all ² Slightly ³ Moderately ⁴ Quite a lot ⁵ Extremely

15. In your own words, **what is a colonoscopy for**?

16. How **confident** are you that your **bowel is totally clean** for the colonoscopy? (*circle one number*)
Not at all confident 1 2 3 4 5 6 7 8 9 10 **Very confident**

PART 2: ABOUT YOU

17. How confident are you filling out medical forms by yourself?
¹ Extremely ² Quite a bit ³ Somewhat ⁴ A little bit ⁵ Not at all

18. How often do you have someone help you read medical materials?
¹ Always ² Often ³ Sometimes ⁴ Occasionally ⁵ Never

19. How often do you have problems learning about your medical condition because of difficulty understanding written information?
¹ Always ² Often ³ Sometimes ⁴ Occasionally ⁵ Never

20. How often do you feel you don't understand what doctors tell you?
¹ Always ² Often ³ Sometimes ⁴ Occasionally ⁵ Never

21. How **informed** about **colon and rectal cancer** do you think you are?
¹ Not at all ² Slightly ³ Moderately ⁴ Quite a lot ⁵ Extremely

22. How **concerned** are you about having **colon or rectal cancer**?
¹ Not at all ² Slightly ³ Moderately ⁴ Quite a lot ⁵ Extremely

23. Please *circle the number* for how much you *agree or disagree* with the following statements:

1=strongly agree 4=disagree	2=agree 5=strongly disagree	3=neither/neutral	strongly agree	agree	neither/neutral	disagree	strongly disagree
a. Doctors treat some patients better than others.			1	2	3	4	5
b. Doctors treat minorities worse than white people.			1	2	3	4	5
c. Doctors treat poor people worse than rich people.			1	2	3	4	5
d. Doctors treat me the same as other patients.			1	2	3	4	5
e. Doctors treat people who <i>don't</i> speak English worse than those who do speak English.			1	2	3	4	5
f. Doctors treat people with low education worse than people with a lot of education.			1	2	3	4	5
g. Doctors treat women worse than men.			1	2	3	4	5
h. Doctors treat people on Medicaid worse than people with private insurance.			1	2	3	4	5
i. I can usually count on being treated with respect by doctors.			1	2	3	4	5
j. I trust that I will get the best care no matter what the costs.			1	2	3	4	5
k. I trust what the doctors tell me.			1	2	3	4	5
l. I trust that hospitals will provide me with the best care possible.			1	2	3	4	5

24. Please *circle the number* for how much you *agree or disagree* with the following statements:

1=strongly agree 3=neither/neutral 4=disagree	2=agree 5=strongly disagree	strongly agree	agree	neither/neutral	disagree	strongly disagree
a. If I had cancer I would do whatever it takes to beat it.		1	2	3	4	5
b. If I had cancer I would take a wait and see approach.		1	2	3	4	5
c. If I had cancer I would want my doctor to make the treatment decisions.		1	2	3	4	5
d. If I had cancer I would gather as much information as possible before I decided on treatment .		1	2	3	4	5
e. If I had cancer I would willingly have surgery to beat it.		1	2	3	4	5
f. If I had cancer I would willingly have chemotherapy (cancer drugs) to beat it.		1	2	3	4	5
g. If I had cancer I would willingly have radiation to beat it.		1	2	3	4	5
h. If I had cancer I would willingly try an experimental treatment to beat it.		1	2	3	4	5
i. If I had cancer I would worry about being a burden on my family.		1	2	3	4	5
j. When there is more than one method to treat a problem, I should be told about each one.		1	2	3	4	5
k. I believe that my doctor needs to know everything about my medical history to take good care of me.		1	2	3	4	5
l. I would rather have my doctor make decisions about what's best for my health than to be given a whole lot of choices.		1	2	3	4	5
m. The important medical decisions should be made by my		1	2	3	4	5

doctor, not by me.					
--------------------	--	--	--	--	--

PART 3: YOUR COLONOSCOPY

25. Is this your first colonoscopy? (*check one box only*)
- ¹ Yes, and it is the first time it was recommended
 - ² Yes, but it was recommended to me before
 - ³ No (How many have you had before? _____)
26. Who **ordered** this colonoscopy for you? (*check one box only*)
- ¹ My regular doctor/family doctor
 - ² Some other doctor (What type of doctor? _____)
 - ³ Some other health care provider (What type of provider? _____)
27. To the best of your knowledge, **why** was this colonoscopy ordered?
- a. Routine based on my age ¹ yes ² no
 - b. Family history of colon or rectal cancer ¹ yes ² no
 - c. Follow-up to a previous colonoscopy ¹ yes ² no
 - d. Follow-up to an abnormal test ¹ yes ² no
 - e. I have been having symptoms or problems ¹ yes ² no
 - f. I asked for the test (Why? _____) ¹ yes ² no
 - g. A family member insisted (Why? _____) ¹ yes ² no
 - h. Other reason (What? _____)
28. How is your colonoscopy being **paid** for? (*check one box only*)
- ¹ Insurance, Medicare, Medicaid, or the VA will pay for **all** of it
 - ² Insurance, Medicare, Medicaid, or the VA will pay for **some** of it
 - ³ I will pay for all of it
 - ⁴ Other (Who? _____)
29. Does having this colonoscopy put a financial strain on you or your family?
- ¹ Yes ² No
30. Do you think this colonoscopy will be worth the financial cost to you?
- ¹ yes ² no
31. Did you do any of the following **on your own** to learn more about colonoscopy?
- a. Read about colonoscopy ¹ yes ² no
 - b. Looked up colonoscopy on the computer ¹ yes ² no
 - c. Talked with someone about their colonoscopy (who? _____) ¹ yes ² no

PART 4: YOUR HEALTH

32. Please answer these questions about your health over the **past 30 days**:

Over the past 30 days...	Days
a. Thinking about your physical health , which includes physical illness and injury, for how many days during the past 30 days was your physical health not good ?	
b. Thinking about your mental health , which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good ?	
c. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities , such as self-care, work, or recreation?	
d. During the past 30 days, for about how many days did pain make it hard for you to do your usual activities, such as self-care, work, or recreation?	

33. This scale asks about your feelings and thoughts during the last month. Please circle *how often* you felt a certain way.

0=Never 1=Almost Never 2=Sometimes 3=Fairly Often 4=Very Often	Never	Almost Never	Sometimes	Fairly Often	Very Often
a. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
b. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
c. In the last month, how often have you felt nervous and “stressed”?	0	1	2	3	4
d. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
e. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
f. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
g. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
h. In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
i. In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
j. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

34. Do you have a regular doctor or other health care provider?

¹ yes ² no

35. Where do you get **most** of your health care? (*check one box only*)

¹ Doctor’s office/practice ³ VA ⁵ Other (where? _____)
² Emergency room ⁴ Urgent care clinic

36. Please tell us if you have taken the medications listed below *every day or most days during the past 6 months*:

a. Multi-vitamins	<input type="checkbox"/> ¹ yes	<input type="checkbox"/> ² no
b. Aspirin	<input type="checkbox"/> ¹ yes	<input type="checkbox"/> ² no
c. Calcium	<input type="checkbox"/> ¹ yes	<input type="checkbox"/> ² no
d. Vitamin C	<input type="checkbox"/> ¹ yes	<input type="checkbox"/> ² no
e. Vitamin D	<input type="checkbox"/> ¹ yes	<input type="checkbox"/> ² no

- f. Statins (for cholesterol) ¹ yes ² no
- g. Coumadin (blood thinner) ¹ yes ² no
- h. Fish oil ¹ yes ² no

37. Please tell us if you have ever used any of the types of tobacco listed below:

Have you ever used?	Never Used	Use now	Used before but quit
a. Cigarettes	<input type="checkbox"/> ¹	<input type="checkbox"/> ² How much per day? _____	<input type="checkbox"/> ³ When quit? _____
b. Cigars	<input type="checkbox"/> ¹	<input type="checkbox"/> ² How much per day? _____	<input type="checkbox"/> ³ When quit? _____
c. Pipe	<input type="checkbox"/> ¹	<input type="checkbox"/> ² How much per day? _____	<input type="checkbox"/> ³ When quit? _____
d. Smokeless (dip, snuff, chew)	<input type="checkbox"/> ¹	<input type="checkbox"/> ² How much per day? _____	<input type="checkbox"/> ³ When quit? _____

38. What is your zip code? _____

39. What is your relationship to the person who came with you today? (*check one box only*)

- ¹ Spouse/partner
- ² Other family member: _____
- ³ Co-worker
- ⁴ Friend or neighbor
- ⁵ Pastor or a church member
- ⁶ Someone else: _____

40. Do you live at the same address as the person who brought you?
¹ Yes ² No

Thank you for your help!
Please answer the questions below – we will cut off this portion of the survey and keep it separately from your responses.



Name: _____

→ What is the best phone number for you?

→ What is the best time to call you?

Staff only -- Study ID number: PT ___ / ___ ___ ___

C. Caregiver Survey

IRB APPROVED
ON 7/28/2012 University of Florida
Pre-Colonoscopy Survey – Caregiver Version Study ID: CG __ / __

ELIGIBILITY

1. What is your relationship to the patient you are with today? (*check one box only*)
¹ Spouse/partner ⁴ Friend or neighbor
² Other family member: _____ ⁵ Pastor or a church member
³ Co-worker ⁶ Someone else: _____
2. If this person were sick and needed a caregiver, would you be someone to do that?
¹ Yes ² No

**STOP! If you are 18 and over and you answered "yes" to question 2, please continue with this survey.
If you are under the age of 18 or you answered "no" to question 2, please do not fill out the survey, just return it to the person who gave it to you.**

PART 1: THE PATIENT'S COLONOSCOPY

3. How is the colonoscopy being paid for? (*check one box only*)
¹ Insurance, Medicare, Medicaid or the VA will pay for **all** of it
² Insurance, Medicare, Medicaid or the VA will pay for **some** of it
³ The patient will pay for **all** of it
⁴ Other (Who? _____)
4. To the best of your knowledge, **why** was this colonoscopy ordered?
a. Routine based on age ¹ yes ² no ³ don't know
b. Family history of colon or rectal cancer ¹ yes ² no ³ don't know
c. Follow-up to a previous colonoscopy ¹ yes ² no ³ don't know
d. Follow-up to an abnormal test ¹ yes ² no ³ don't know
e. Patient was having symptoms or problems ¹ yes ² no ³ don't know
f. Patient asked for the test ¹ yes ² no ³ don't know
g. A family member insisted the patient have it ¹ yes ² no ³ don't know
h. Other reason (What? _____)
5. Did any of the following cause problems for the **patient** in getting the colonoscopy?
a. Getting an appointment ¹ yes ² no ³ don't know
b. Patient getting time off work ¹ yes ² no ³ don't know
c. Getting a ride ¹ yes ² no ³ don't know
d. You getting time off work ¹ yes ² no ³ don't know
e. How much it costs ¹ yes ² no ³ don't know
f. Arranging child or elder care ¹ yes ² no ³ don't know
g. Other _____ ¹ yes ² no ³ don't know



6. Before today, did the patient have any of the following communications about the colonoscopy?
- a. Talked to the **doctor** doing the colonoscopy **in person** ¹ yes ² no ³ don't know
 - b. Talked to the **doctor** doing the colonoscopy by **phone** ¹ yes ² no ³ don't know
 - c. Talked to a **nurse** from the colonoscopy center **in person** ¹ yes ² no ³ don't know
 - d. Talked to a **nurse** from the colonoscopy center by **phone** ¹ yes ² no ³ don't know
 - e. Received materials **by mail** from the colonoscopy center ¹ yes ² no ³ don't know
 - f. Other (what? _____)
7. About how many minutes do you **think** the doctor will spend with the patient **BEFORE** the colonoscopy? _____ minutes
8. About how many minutes do you **think** the doctor will spend with the patient **AFTER** the colonoscopy? _____ minutes
9. **How** do you think the patient will get the **results** from the colonoscopy?
- a. **Doctor** doing the colonoscopy will **tell the patient** right afterwards ¹ yes ² no
 - b. **Doctor** doing the colonoscopy will **telephone** the patient ¹ yes ² no
 - c. **Nurse** from the colonoscopy center will tell the patient right afterwards ¹ yes ² no
 - d. **Nurse** from the colonoscopy center will **telephone** the patient ¹ yes ² no
 - e. The patient will get a **printed report** afterwards ¹ yes ² no
 - f. The patient will get a **letter in the mail** from the colonoscopy center ¹ yes ² no
 - g. The patient's **personal doctor** will tell him or her ¹ yes ² no
 - h. Other (how? _____)
10. How would you **MOST LIKE** for the patient to get the results?

11. What do you **expect** the results of the colonoscopy will show?

12. How **confident** are you that the patient's **bowel is totally clean** for the colonoscopy? *(circle one number)*
Not at all confident 1 2 3 4 5 6 7 8 9 10 **Very confident**

PART 2: YOUR THOUGHTS ABOUT COLONOSCOPIES

13. Did **you** have any problems bringing the patient in for the colonoscopy?
¹ Yes (what? _____) ² No
14. Have you personally had a colonoscopy before?
¹ Yes ² No



15. Did you help the patient prepare for the colonoscopy?
¹ Yes (how? _____) ² No
16. How much **benefit (help)** to the patient's health is having a colonoscopy? (*circle one number*)
No benefit at all 1 2 3 4 5 6 7 8 9 10 **Very high benefit**
17. How much **risk (possible harm)** to the patient's health is having a colonoscopy?
(*circle one number*)
No risk at all 1 2 3 4 5 6 7 8 9 10 **Very high risk**
18. Do you agree or disagree with the patient's decision to have a colonoscopy? (*circle one number*)
Strongly disagree 1 2 3 4 5 6 7 8 9 10 **Strongly agree**
19. In your own words, **what is a colonoscopy for?**

20. How informed about colonoscopy do you think you are?
¹ Not at all ² Slightly ³ Moderately ⁴ Quite a lot ⁵ Extremely
21. Did **you** do any of the following to learn more about colonoscopy?
a. Read about colonoscopy ¹ yes ² no
b. Looked up colonoscopy on the computer ¹ yes ² no
c. Talked with someone about their colonoscopy (who? _____) ¹ yes ² no
22. Do you think the doctor will talk with **YOU** about the results **today**?
¹ Yes ² No

PART 3: ABOUT THE PATIENT

23. Overall, how would you rate **the patient's** health during **the past 4 weeks**? (*check one box*)
¹ Excellent ² Very Good ³ Good ⁴ Fair ⁵ Poor ⁶ Very poor
24. On a scale of 1 to 10, how **anxious** is **the patient feeling TODAY**? (*circle one*)
Not at all anxious 1 2 3 4 5 6 7 8 9 10 **Very anxious**



25. Please **circle the number** for how much you **agree or disagree** with the following statements:

1=strongly agree	2=agree	3=neither/neutral	4=disagree	5=strongly disagree	strongly agree	agree	neither/neutral	disagree	strongly disagree
a. If the patient had cancer he or she would do whatever it takes to beat it.					1	2	3	4	5
b. If the patient had cancer he or she would take a wait and see approach.					1	2	3	4	5
c. If the patient had cancer he or she would want the doctor to make the treatment decisions.					1	2	3	4	5
d. If the patient had cancer he or she would gather as much information as possible before he or she decided on treatment.					1	2	3	4	5
e. If the patient had cancer he or she would willingly have surgery to beat it.					1	2	3	4	5
f. If the patient had cancer he or she would willingly have chemotherapy (cancer drugs) to beat it.					1	2	3	4	5
g. If the patient had cancer he or she would willingly have radiation to beat it.					1	2	3	4	5
h. If the patient had cancer he or she would willingly try an experimental treatment to beat it.					1	2	3	4	5
i. If the patient had cancer he or she would worry about being a burden on the family.					1	2	3	4	5

PART 4: ABOUT YOU

26. Overall, how would you rate **YOUR** health during the **past 4 weeks?** (check one box)
¹ Excellent ² Very Good ³ Good ⁴ Fair ⁵ Poor ⁶ Very poor

27. On a scale of 1 to 10, how **anxious** are **YOU** feeling **TODAY?** (circle one)
Not at all anxious 1 2 3 4 5 6 7 8 9 10 **Very Anxious**

28. How confident are you filling out medical forms by yourself?
¹ Extremely ² Quite a bit ³ Somewhat ⁴ A little bit ⁵ Not at all

29. How often do you have someone help you read medical materials?
¹ Always ² Often ³ Sometimes ⁴ Occasionally ⁵ Never

30. How often do you have problems learning about your medical condition because of difficulty understanding written information?
¹ Always ² Often ³ Sometimes ⁴ Occasionally ⁵ Never



31. How often do you feel you don't understand what the doctor tells you?
 Always Often Sometimes Occasionally Never

32. Please **circle the number** for how much you **agree or disagree** with the following statements:

1=strongly agree	2=agree	3=neither/neutral	4=disagree	5=strongly disagree	strongly agree	agree	neither/neutral	disagree	strongly disagree
a. When there is more than one method to treat a problem, I should be told about each one .	1	2	3	4	5				
b. I believe that my doctor needs to know everything about my medical history to take good care of me.	1	2	3	4	5				
c. I would rather have my doctor make decisions about what's best for my health than to be given a whole lot of choices.	1	2	3	4	5				
d. The important medical decisions should be made by my doctor , not by me.	1	2	3	4	5				

33. Please **circle the number** for how much you **agree or disagree** with the following statements:

1=strongly agree	2=agree	3=neither/neutral	4=disagree	5=strongly disagree	strongly agree	agree	neither/neutral	disagree	strongly disagree
a. If I had cancer I would do whatever it takes to beat it .	1	2	3	4	5				
b. If I had cancer I would take a wait and see approach .	1	2	3	4	5				
c. If I had cancer I would want my doctor to make the treatment decisions .	1	2	3	4	5				
d. If I had cancer I would gather as much information as possible before I decided on treatment .	1	2	3	4	5				
e. If I had cancer I would willingly have surgery to beat it .	1	2	3	4	5				
f. If I had cancer I would willingly have chemotherapy (cancer drugs) to beat it .	1	2	3	4	5				
g. If I had cancer I would willingly have radiation to beat it .	1	2	3	4	5				
h. If I had cancer I would willingly try an experimental treatment to beat it .	1	2	3	4	5				
i. If I had cancer I would worry about being a burden on my family .	1	2	3	4	5				

34. How **informed about colon and rectal cancer** do you think you are?
 Not at all Slightly Moderately Quite a lot Extremely



35. How **concerned** are you about the patient having **colon or rectal cancer**?
¹ Not at all ² Slightly ³ Moderately ⁴ Quite a lot ⁵ Extremely

36. Please **circle the number** for how much you **agree or disagree** with the following statements:

1=strongly agree 2=agree 3=neither/neutral 4=disagree 5=strongly disagree	strongly agree	agree	neither/neutral	disagree	strongly disagree
a. Doctors treat some patients better than others.	1	2	3	4	5
b. Doctors treat minorities worse than white people.	1	2	3	4	5
c. Doctors treat poor people worse than rich people.	1	2	3	4	5
d. Doctors treat me the same as other patients.	1	2	3	4	5
e. Doctors treat people who don't speak English worse than those who do speak English.	1	2	3	4	5
f. Doctors treat people with low education worse than people with a lot of education.	1	2	3	4	5
g. Doctors treat women worse than men.	1	2	3	4	5
h. Doctors treat people on Medicaid worse than people with private insurance.	1	2	3	4	5
i. I can usually count on being treated with respect by doctors.	1	2	3	4	5
j. I trust that I will get the best care no matter what the costs.	1	2	3	4	5
k. I trust what the doctors tell me.	1	2	3	4	5
l. I trust that hospitals will provide me with the best care possible.	1	2	3	4	5

Please fill out this information about YOURSELF	Please fill out this information about the PATIENT
37a. What is your sex? <input type="checkbox"/> ¹ Female <input type="checkbox"/> ² Male	37b. What is the patient's sex? <input type="checkbox"/> ¹ Female <input type="checkbox"/> ² Male
38a. How old were you on your last birthday? _____ Years	38b. How old was the patient on his/her last birthday? _____ Years
39a. Are you of Hispanic or Latino descent? <input type="checkbox"/> ¹ Yes <input type="checkbox"/> ² No	39b. Is the patient of Hispanic or Latino descent? <input type="checkbox"/> ¹ Yes <input type="checkbox"/> ² No



<p>40a. What is your race? <input type="checkbox"/>¹ American Indian/Alaskan native <input type="checkbox"/>² Asian/Asian American <input type="checkbox"/>³ Black/ African American <input type="checkbox"/>⁴ Native Hawaiian/ Pacific Islander <input type="checkbox"/>⁵ White/Caucasian <input type="checkbox"/>⁶ Other: _____</p> <p>41a. Is English your preferred language? <input type="checkbox"/>¹ Yes <input type="checkbox"/>² No</p> <p>42a. Are you currently employed for pay? <input type="checkbox"/>¹ Yes, full-time <input type="checkbox"/>² Yes, part-time <input type="checkbox"/>³ No, retired <input type="checkbox"/>⁴ No, disabled <input type="checkbox"/>⁵ No, looking for work <input type="checkbox"/>⁶ Other _____</p> <p>42.1a. If employed, what is your occupation? _____ or If retired, what was your occupation? _____</p> <p>43a. What is your marital status? <input type="checkbox"/>¹ Married/living with partner <input type="checkbox"/>² Divorced <input type="checkbox"/>³ Widowed <input type="checkbox"/>⁴ Single</p> <p>44a. Please estimate your total yearly household income: (check one box) <input type="checkbox"/>¹ less than \$10,000 <input type="checkbox"/>² \$10,000 to \$19,999 <input type="checkbox"/>³ \$20,000 to \$29,999 <input type="checkbox"/>⁴ \$30,000 to \$39,999 <input type="checkbox"/>⁵ \$40,000 to \$49,999 <input type="checkbox"/>⁶ \$50,000 to \$59,999 <input type="checkbox"/>⁷ \$60,000 to \$69,999 <input type="checkbox"/>⁸ \$70,000 to \$79,999 <input type="checkbox"/>⁹ \$80,000 or more</p>	<p>40b. What is the patient's race? <input type="checkbox"/>¹ American Indian/Alaskan native <input type="checkbox"/>² Asian/Asian American <input type="checkbox"/>³ Black/ African American <input type="checkbox"/>⁴ Native Hawaiian/ Pacific Islander <input type="checkbox"/>⁵ White/Caucasian <input type="checkbox"/>⁶ Other: _____</p> <p>41b. Is English the patient's preferred language? <input type="checkbox"/>¹ Yes <input type="checkbox"/>² No</p> <p>42b. Is the patient currently employed for pay? <input type="checkbox"/>¹ Yes, full-time <input type="checkbox"/>² Yes, part-time <input type="checkbox"/>³ No, retired <input type="checkbox"/>⁴ No, disabled <input type="checkbox"/>⁵ No, looking for work <input type="checkbox"/>⁶ Other _____</p> <p>42.1b. If employed, what is the patient's occupation? _____ or If retired, what was the patient's occupation? _____</p> <p>43b. What is the patient's marital status? <input type="checkbox"/>¹ Married/living with partner <input type="checkbox"/>² Divorced <input type="checkbox"/>³ Widowed <input type="checkbox"/>⁴ Single</p> <p>44b. Please estimate the patient's total yearly household income: (check one box) <input type="checkbox"/>¹ less than \$10,000 <input type="checkbox"/>² \$10,000 to \$19,999 <input type="checkbox"/>³ \$20,000 to \$29,999 <input type="checkbox"/>⁴ \$30,000 to \$39,999 <input type="checkbox"/>⁵ \$40,000 to \$49,999 <input type="checkbox"/>⁶ \$50,000 to \$59,999 <input type="checkbox"/>⁷ \$60,000 to \$69,999 <input type="checkbox"/>⁸ \$70,000 to \$79,999 <input type="checkbox"/>⁹ \$80,000 or more</p>
---	--



<p>45a. How many people are supported on this income? _____ People</p> <p>46a. Please circle the highest grade in school you completed: <i>(circle one number)</i> <i>Elementary:</i> 0 1 2 3 4 5 6 7 8 <i>High school:</i> 9 10 11 12 <i>GED:</i> 12 <i>College/technical school:</i> 13 14 15 16 <i>Graduate:</i> 17 or more</p> <p>47a. Are you a veteran? <input type="checkbox"/>¹ Yes <input type="checkbox"/>² No</p>	<p>45b. How many people are supported on this income? _____ People</p> <p>46b. Please circle the patient's highest grade in school completed: <i>(circle one number)</i> <i>Elementary:</i> 0 1 2 3 4 5 6 7 8 <i>High school:</i> 9 10 11 12 <i>GED:</i> 12 <i>College/technical school:</i> 13 14 15 16 <i>Graduate:</i> 17 or more</p> <p>47b. Is the patient a veteran? <input type="checkbox"/>¹ Yes <input type="checkbox"/>² No</p>
---	--

Thank you for your help!
Please answer the questions below – we will cut off this portion of the survey and keep it separately from your responses.



Name: _____

If we need to contact you in the future...
 → What is your preferred phone number? _____
 → What is your preferred time of day? _____

Staff only -- Study ID number: CG __ / _____

D. Human Subject Research Determination Form



UNIVERSITY OF
MARYLAND

INSTITUTIONAL REVIEW BOARD

1204 Marie Mount Hall
College Park, MD 20742-5125
TEL 301.405.4212
FAX 301.314.1475
irb@umd.edu
www.umresearch.umd.edu/IRB

DATE: December 12, 2017

TO: Shanelle O'Connor
FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [1168236-1] Supplement Use Among a Pre Colonoscopy Population

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF NOT HUMAN SUBJECT RESEARCH
DECISION DATE: December 12, 2017

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has determined this project does not meet the definition of human subject research under the purview of the IRB according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.

E. Timeline

	September (week)				October				November				December				January				February				March				April					
(week)	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2
Choose Research Question		█																																
Choose Committee		█																																
Complete Literature Review		█																																
Chapter 1			█																															
Chapter 2				█																														
Edited chapter 1				█																														
Chapter 3					█																													
Edited chapter 2					█																													
Edited chapter 3						█																												
Full Paper						█																												
Send paper to committee						█																												
Book room for proposal defense						█																												
Proposal Defense							█	█																										
Actual Defense											█																							
Proposal revisions												█	█	█	█	█																		
Full paper with all revisions																	█																	
Book room for proposal defense																		█																
Full paper to committee																			█															
Proposal Defense																				█														
Chapter 1- 3 revisions																																		
Chapter 4 and 5 outline																																		

	September				October				November				December				January				February				March				April							
(week)	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2						
Nomination of thesis or dissertation committee form																																				
Analysis-Research Question 1																																				
Analysis-Research Question 2																																				
Data Interpretation																																				
Chapter 4																																				
Revision 1																																				
Revision 2																																				
Chapter 5																																				
Revision 1																																				
Revision 2																																				
Full Paper																																				
Revision 1																																				
Revision 2																																				
Meet with Dr. Curbow																																				
Meet with Dr. Garza																																				
Committee revisions																																				
Defense meeting announcement form																																				
Final draft to committee																																				
Thesis Defense																																				

References

- Acott, A., Theus, S., Marchant-Miros, K., & Mancino, A., F.A.C.S. (2008). Association of tobacco and alcohol use with earlier development of colorectal cancer: Should we modify screening guidelines? *The American Journal of Surgery*, 196(6), 915-919. doi:10.1016/j.amjsurg.2008.07.033
- Albert, C. M., Cook, N. R., Gaziano, J. M., Zaharris, E., MacFadyen, J., Danielson, E., ... & Manson, J. E. (2008). Effect of folic acid and B vitamins on risk of cardiovascular events and total mortality among women at high risk for cardiovascular disease: a randomized trial. *Jama*, 299(17), 2027-2036.
- Algra, A.M., Rothwell, P.M. (2012). Effects of regular aspirin on long-term cancer incidence and metastasis: a systematic comparison of evidence from observational studies versus randomised trials. *Lancet Oncology*, 13(5):518.
- American Cancer Society. (2017). American Cancer Society Recommendations for Colorectal Cancer Early Detection. <https://www.cancer.org/cancer/colon-rectal-cancer/detection-diagnosis-staging/acs-recommendations.html>
- American Cancer Society. (2017). Colorectal Cancer Facts and Figures 2017-2019. <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/colorectal-cancer-facts-and-figures/colorectal-cancer-facts-and-figures-2017-2019.pdf>
- American Cancer society. (2017). What is Colorectal Cancer? <https://www.cancer.org/cancer/colon-rectal-cancer/about/what-is-colorectal-cancer.html>
- American Cancer Society, (2016). Can Colorectal Cancer be Prevented? <https://www.cancer.org/cancer/colon-rectal-cancer/causes-risks-prevention/prevention.html>
- American Cancer Society. (2015). What is Cancer. <https://www.cancer.org/cancer/cancer-basics/what-is-cancer.html>
- Ann Chao, Michael J. Thun, Eric J. Jacobs, S. Jane Henley, Carmen Rodriguez, Eugenia E. Calle; Cigarette Smoking and Colorectal Cancer Mortality in the Cancer Prevention Study II, JNCI: Journal of the National Cancer Institute, Volume 92, Issue 23, 6 December 2000, Pages 1888–1896, <https://doi.org/10.1093/jnci/92.23.1888> <https://academic.oup.com/jnci/article/92/23/1888/2906035/Cigarette-Smoking-and-Colorectal-Cancer-Mortality>
- Bailey, R. L., Fulgoni III, V. L., Keast, D. R., & Dwyer, J. T. (2011). Dietary supplement use is associated with higher intakes of minerals from food sources—. *The American journal of clinical nutrition*, 94(5), 1376-1381.

- Bell, R. (2015). CANCER. *Science*, 6238, 1036-1039.
- Bibbins-Domingo K, U.S. Preventive Services Task Force. (2016). Aspirin use for the primary prevention of cardiovascular disease and colorectal cancer: U.S. preventive services task force recommendation statement. *Annals of Internal Medicine*, 164(12), 836-45. doi:10.7326/M16-0577
- Blumberg, JB., Frei, B., Fulgoni VL 3rd, Weaver, CM., Zeisel, SH. (2016). Vitamin and mineral intake is inadequate for most Americans: What should we advise patients about supplements? *Journal of Family Practice*;65(9), S1-S8.
- Blumberg, J., Frei, B., Fulgoni, V., Weaver, C., & Zeisel, S. (2017). Contribution of dietary supplements to nutritional adequacy in various adult age groups. *Nutrients*, 9(12), 1325-1325. doi:10.3390/nu9121325
- Blumberg, J., Frei, B., Fulgoni, V., Weaver, C., & Zeisel, S. (2017). Contribution of dietary supplements to nutritional adequacy in Race/Ethnic Populations Subgroups in the united states. *Nutrients*, 9(12). doi:10.3390/nu9121295
- Bond, J. H. (1999). Calcium supplements for the prevention of colorectal adenomas. *New England Journal of Medicine*, 340(2), 101-107.
- Brody, H. (2014). Cancer. *Nature*, 509(7502 Suppl), 49. doi:10.1038/509S49a
- Chung JY, Lee DH, Park JH, Lee MK, Kang DW, Min J, Kim DI, Jeong DH, Kim NK, Meyerhardt JA, Jones LW, Jeon JY. (2013). Patterns of physical activity participation across the cancer trajectory in colorectal cancer survivors. *Supportive Care in Cancer: Official Journal of the Multinational Association of Supportive Care in Cancer*, 21(6), 1605-12. doi:10.1007/s00520-012-1703-5
- Center for Disease Control and Prevention. (1993). 1993 Behavioral Risk Factor Questionnaire. Behavioral risk Factor surveillance System.
- Center for Disease Control and Prevention. (2015). Colorectal Cancer Risk by Age. <https://www.cdc.gov/cancer/colorectal/statistics/age.htm>
- Center for disease Control and Prevention. (2016). NHANES 2013-2014 Dietary Data: Dietary Supplement Use 30-Day - Total Dietary Supplements. https://wwwn.cdc.gov/Nchs/Nhanes/2013-2014/DSQTOT_H.htm
- Center for Disease Control and Prevention. (2017). Fact Sheets - Excessive Alcohol Use and Risks to Women's Health. <https://www.cdc.gov/alcohol/fact-sheets/womens-health.htm>
- Center for Disease Control and Prevention. (2017). Vitamin D Supplementation. https://www.cdc.gov/breastfeeding/recommendations/vitamin_d.htm

- Chan, A. T., & Giovannucci, E. L. (2010). Primary prevention of colorectal cancer. *Gastroenterology*, 138(6), 2029-2043.
- Chitayat, D., Matsui, D., Amitai, Y., Kennedy, D., Vohra, S., Rieder, M., Koren, G. (2016). Folic acid supplementation for pregnant women and those planning pregnancy: 2015 update. *Journal of Clinical Pharmacology*, 56(2), 170-5. doi:10.1002/jcph.616
- Cho, E., Smith-Warner, S. A., Spiegelman, D., Beeson, W. L., van den Brandt, P. A., Colditz, G. A., ... & Goldbohm, R. A. (2004). Dairy foods, calcium, and colorectal cancer: a pooled analysis of 10 cohort studies. *Journal of the National Cancer Institute*, 96(13), 1015-1022
- Clarke TC, Black LI, Stussman BJ, Barnes PM, Nahin RL. (2015). Trends in the use of complementary health approaches among adults: United States, 2002-2012. *National Health Statistics Report*;(79):1-16.
- Curbow, B.A., Dailey, A.B., King-Marshall, E.C., Barnett, T.E., Schumacher, J.R., Sultan, S., George, T.J. Jr. (2015). Pathways to colonoscopy in the south: Seeds of health disparities. *American Journal of Public Health*, 105(4), 103-11. doi:10.2105/AJPH.2014.302347
- Datta M, Vitolins MZ. (2016). Food fortification and supplement use-Are there health implications? *Critical Reviews in Food Science and Nutrition*, 56(13), 2149-59. doi:10.1080/10408398.2013.818527
- Dickinson A, Blatman J, El-Dash N, Franco JC. (2014). Consumer usage and reasons for using dietary supplements: Report of a series of surveys. *Journal of the American College of Nutrition*, 33(2), 176-82. doi:10.1080/07315724.2013.875423
- Dickinson, A., MacKay, D., & Wong, A. (2015). Consumer attitudes about the role of multivitamins and other dietary supplements: report of a survey. *Nutrition Journal*, 14, 66. <http://doi.org/10.1186/s12937-015-0053-9>
- Fisher, P. (2016). Cancer and quality of life. *Homeopathy*, 105(4), 287-288. doi:10.1016/j.homp.2016.11.001
- Food and Drug Administration. (2017). Fortify our Knowledge about Vitamins. <https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm118079.htm>
- Food and Drug Administration. (2017). Tips for Older Dietary Supplement Users. <https://www.fda.gov/Food/DietarySupplements/UsingDietarySupplements/ucm110493.htm>

- Footo, J.A., Murphy, S.P., Wilkens, L.R., Hankin, J.H., Henderson, B.E., Kolonel, L.N. (2003). Factors associated with dietary supplement use among healthy adults of five ethnicities: The multiethnic cohort study. *American Journal of Epidemiology*, 157(10), 888-97.
- Gahche, J.J., Potischman, N., Dwyer, J.T., Bailey, R.L. (2017). Dietary supplement use was very high among older adults in the United States in 2011-2014. *Journal of Nutrition*, 147(10), 1968-1976. doi:10.3945/jn.117.255984
- Glanz, K., Rimer, B., & National Cancer Institute (U.S.). (1997). Theory at a glance : A guide for health promotion practice (NIH publication, no. 97-3896). Bethesda, Md.: U.S. Dept. of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute.
- Golshiri, P., Rasooli, S., Emami, M., Najimi, A. (2016). Effects of physical activity on risk of colorectal cancer: A case-control study. *International Journal of Preventive Medicine*, 7, 32-32. doi:10.4103/2008-7802.175991
- Greiner, K., Born, W., Nollen, N., & Ahluwalia, J. (2005). Knowledge and perceptions of colorectal cancer screening among urban african americans. *Journal of General Internal Medicine*, 20(11), 977-983. doi:10.1111/j.1525-1497.2005.00165.x
- Harris, S.S. (2006). Vitamin D and African Americans. *The Journal of Nutrition*, 136(4), 1126-9.
- Heine-Broring, Renate C. Heine-Broring ¹, Renate M. Winkels ¹, Jacoba M.S. Renkema ², Lea Kragt ¹, Anne-Claire B. van Orten-Luiten ¹, Ettje F. Tigchelaar ¹, Doris S.M. Chan ³, Teresa Norat ³ and Kampman, E. (2015). Dietary supplement use and colorectal cancer risk: A systematic review and meta-analysis of prospective cohort studies. *International Journal of Cancer*, 136(10), 2388–2401. <http://onlinelibrary.wiley.com/doi/10.1002/ijc.29277/pdf>
- Heydarnejad, M., Hassanpour, D. A., & Solati, D. K. (2011). Factors affecting quality of life in cancer patients undergoing chemotherapy. *African Health Sciences*, 11(2), 266–270.
- Hoffmeister, M., Chang-Claude, J., & Brenner, H. (2007). Individual and joint use of statins and low-dose aspirin and risk of colorectal cancer: A population-based case-control study. *International Journal of Cancer*, 121(6), 1325-1330. doi:10.1002/ijc.22796
- Howard, R., Freedman, D., Park, Y., Hollenbeck, A., Schatzkin, A., & Leitzmann, M. (2008). Physical activity, sedentary behavior, and the risk of colon and rectal cancer in the NIH-AARP diet and health study. *Cancer Causes & Control : An*

International Journal of Studies of Cancer in Human Populations, 19(9), 939-953. doi:10.1007/s10552-008-9159-0

Haun J, Dodd VJ, Varnass JW, Graham-Pole J, Rienzo B, Donaldson P. (2009). Testing the brief health literacy screening tool: Implications for utilization of a BRIEF health literacy indicator. *Federal Practitioner Journal*, 26 (12):24-28, 30-31.

Imai, T., Otsuka, R., Kato, Y., Ando, F., & Shimokata, H. (2015). A longitudinal study of dietary supplement use in community-living middle age and elderly Japanese. *International Journal of Epidemiology*, 44(Suppl_1), 186. doi:10.1093/ije/dyv096.282

Institute of Medicine. 2004. *Health Literacy: A Prescription to End Confusion*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/10883>.

Jaime J Gahche, Regan L Bailey, Nancy Potischman, Johanna T Dwyer; Dietary Supplement Use Was Very High among Older Adults in the United States in 2011–2014, *The Journal of Nutrition*, Volume 147, Issue 10, 1 October 2017, Pages 1968–1976, <https://doi.org/10.3945/jn.117.255984>

Jasti, S., Siega-Riz, AM., & Bentley, ME. (2003). Dietary supplement use in the context of health disparities: Cultural, ethnic and demographic determinants of use. *The Journal of Nutrition*, 133(6), 2010.

Ji BT, Weissfeld JL, Chow WH, Huang WY, Schoen RE, Hayes RB. (2006). Tobacco smoking and colorectal hyperplastic and adenomatous polyps. *Cancer Epidemiology, Biomarkers & Prevention : A Publication of the American Association for Cancer Research*, Cosponsored by the *American Society of Preventive Oncology*, 15(5), 897-901. <http://cebp.aacrjournals.org/content/15/5/897.full>

Kantor ED, Rehm CD, Du M, White E, Giovannucci EL. (2016). Trends in Dietary Supplement Use Among US Adults From 1999-2012. *Journal of American Medical Association*; 316(14),1464–1474. doi:10.1001/jama.2016.14403

Karen Fiumara, K., Goldhaber, SZ. (2009). A Patient's Guide to Taking Coumadin/Warfarin. *Circulation*, 19:e220-e222. <https://doi.org/10.1161/CIRCULATIONAHA.108.803957>

King-Marshall, E., Mueller, N., Dailey, A., Barnett, T., George, T., Sultan, S., & Curbow, B. (2016). "It is just another test they want to do": Patient and caregiver understanding of the colonoscopy procedure. *Patient Education and Counseling*, 99(4), 651-658. doi:10.1016/j.pec.2015.10.021

- Lambert, M. (2014). ACC/AHA release updated guideline on the treatment of blood cholesterol to reduce aSCVD risk. *American Family Physician*, 90(4), 260.
- Lanas, A., Soriano-Gabarró, M., García Rodríguez, L., Bromley, S., & Cea Soriano, L. (2017). New use of low-dose aspirin and risk of colorectal cancer by stage at diagnosis: A nested case–control study in uK general practice. *Bmc Cancer*, 17(1), 1-11. doi:10.1186/s12885-017-3594-9
- Lynes K, Kazmi SA, Robery JD, Wong S, Gilbert D, Thaha MA. (2016). Public appreciation of lifestyle risk factors for colorectal cancer and awareness of bowel cancer screening: A cross-sectional study. *International Journal of Surgery (London, England)*, 36, 312-318. doi:10.1016/j.ijso.2016.11.002
- Marley, A. R., & Nan, H. (2016). Epidemiology of colorectal cancer. *International Journal of Molecular Epidemiology and Genetics*, 7(3), 105–114.
- Mayo Clinic. (2017). Complementary and Alternative Medicine. Mayo Foundation for Medical Education and Research. <https://www.mayoclinic.org/tests-procedures/complementary-alternative-medicine/basics/definition/prc-20021745>
- Meester RG, Doubeni CA, Lansdorp-Vogelaar I, Jensen CD, van der Meulen MP, Levin TR, Quinn VP, Schottinger JE, Zauber AG, Corley DA, van Ballegooijen M. (2015). Variation in adenoma detection rate and the lifetime benefits and cost of colorectal cancer screening: A microsimulation model. *Journal of the American Medical Association*, 313(23), 2349-58. doi:10.1001/jama.2015.6251
- McMullin, J. (2016). Cancer. *Annual Review of Anthropology*, 45(1), 251-266. doi:10.1146/annurev-anthro-102215-100217
- Murphy, A. B., Kelley, B., Nyame, Y. A., Martin, I. K., Smith, D. J., Castaneda, L., ... Kittles, R. A. (2012). Predictors of Serum Vitamin D Levels in African American and European American Men in Chicago. *American Journal of Men's Health*, 6(5), 420–426. <http://doi.org/10.1177/1557988312437240>
- National Cancer Institute. (2015). Cancer Treatment: Complementary and Alternative Medicine. <https://www.cancer.gov/about-cancer/treatment/cam>
- National Center for Complementary and Integrative Health. (2005). “Get the FACTS – What Is Complementary and Alternative Medicine (CAM)?” Available at <http://nccam.nih.gov/health/whatiscam>
- National Center for Complementary and Integrative Health. (2014). Using Dietary Supplements Wisely. <https://nccih.nih.gov/health/supplements/wiseuse.htm>

- National Institute on Aging. (2013). Dietary Supplements. <https://www.agingcare.com/articles/dietary-supplements-for-seniors-more-is-not-always-better-133854.htm>
- Nomura SJ, Dash C, Rosenberg L, Yu J, Palmer JR, Adams-Campbell LL. (2016). Is adherence to diet, physical activity, and body weight cancer prevention recommendations associated with colorectal cancer incidence in african american women? *Cancer Causes and Control* : Ccc, 27(7), 869-79. doi:10.1007/s10552-016-0760-3
- Office of Dietary Supplements. (2016). VITAMIN AND MINERAL SUPPLEMENT FACT SHEETS. <https://ods.od.nih.gov/factsheets/list-VitaminsMinerals/>
- Office of Dietary Supplements. (2011). Dietary Supplements: What You Need to Know. https://ods.od.nih.gov/HealthInformation/DS_WhatYouNeedToKnow.aspx
- Orji, R., Vassileva, J., & Mandryk, R. (2012). Towards an Effective Health Interventions Design: An Extension of the Health Belief Model. *Online Journal of Public Health Informatics*, 4(3), ojphi.v4i3.4321. <http://doi.org/10.5210/ojphi.v4i3.4321>
- Parikh, A., Robinson, J., Zaydfudim, V., Penson, D., & Whiteside, M. (2014). The effect of health insurance status on the treatment and outcomes of patients with colorectal cancer. *Journal of Surgical Oncology*, 110(3), 227-232. doi:10.1002/jso.23627
- Paskett, ED., Reeves, KW., Rohan, TE., Allison, MA., Williams, CD., Messina, CR., Whitlock, E., Sato, A., Hunt, JR. Association Between Cigarette Smoking and Colorectal Cancer in the Women's Health Initiative, JNCI: *Journal of the National Cancer Institute*, 99(21), 1729–1735, <https://doi-org.proxy-um.researchport.umd.edu/10.1093/jnci/djm176>
- Pawlak, R., Connell, C., Brown, D., Meyer, M. K., & Yadrick, K. (2005). Predictors of multivitamin supplement use amongst African-American female students: A prospective study utilizing the theory of planned behavior. *Ethnicity & Disease*, 15, 540-547.
- Pericleous, M., Mandair, D., & Caplin, M. E. (2013). Diet and supplements and their impact on colorectal cancer. *Journal of Gastrointestinal Oncology*, 4(4), 409–423. <http://doi.org/10.3978/j.issn.2078-6891.2013.003>
- Perterson, MH., N, Fowke J, et al. (2008). Colonoscopy screening in African Americans and Whites with affected first-degree relatives. *Archives Internal Medicine*, 168 (6), 625-631.

- Pietrzyk, Ł. (2017). Food properties and dietary habits in colorectal cancer prevention and development. *International Journal of Food Properties*, 20(10), 2323-2343.
- Pisani, D. (2009). Commentary: How obesity and physical activity contribute to colorectal cancer. *Colorectal Disease : The Official Journal of the Association of Coloproctology of Great Britain and Ireland*, 11(7), 701-4. doi:10.1111/j.1463-1318.2009.02001.x
- Prentice, R. L., Pettinger, M. B., Jackson, R. D., Wactawski-Wende, J., Lacroix, A. Z., Anderson, G. L., ... & Datta, M. (2013). Health risks and benefits from calcium and vitamin D supplementation: Women's Health Initiative clinical trial and cohort study. *Osteoporosis International*, 24(2), 567-580.
- Pusatcioglu, CK. & Braunschweig, C. (2011). Moving beyond diet and colorectal cancer. *Journal of the American Dietetic Association*, 111(10), 1476-8. doi:10.1016/j.jada.2011.07.015
- Ruxton, C. (2004). Health benefits of omega-3 fatty acids. *Nursing Standard (royal College of Nursing (great Britain) : 1987)*, 18(48), 38-42.
- Rioux FM, LeBlanc CP. (2007). Iron supplementation during pregnancy: What are the risks and benefits of current practices? *Applied Physiology, Nutrition, and Metabolism = Physiologie Appliquee, Nutrition Et Metabolisme*, 32(2), 282-8.
- Sax, A., Jenkins, D., Devin, J., Hughes, G., Bolam, K., & Skinner, T. (2014). The insulin-like growth factor axis: A biological mechanism linking physical activity to colorectal cancer survival. *Cancer Epidemiology*, 38(4), 455-459. doi:10.1016/j.canep.2014.05.011
- Silver, J. (2015). Cancer prehabilitation and its role in improving health outcomes and reducing health care costs. *Seminars in Oncology Nursing*, 31(1), 13-30. doi:10.1016/j.soncn.2014.11.003
- Slattery, ML. (2004). Physical activity and colorectal cancer. *Sports Medicine*, 34(4):239-52.
- Simon, S. (2017). Study Finds Sharp Rise in Colon Cancer and Rectal Cancer Rates Among Young Adults. *American Cancer Society*.
- Smith, DL. (2000). Anemia in the elderly. *American Family Physician*, 62(7), 1565-72.
- Stave, E. (2015). Nutritional Supplement Use of an Urban African American and White Population. *Federation of American Societies for Experimental Biology Journal*, 29:586, 0892-6638.
- Sunycz, J. A. (2008). The use of calcium and vitamin D in the management of osteoporosis. *Therapeutics and Clinical Risk Management*, 4(4), 827-836.

- Tong, L., Ahn, C., Symanski, E., Lai, D., & Du, X., Center for Health Services Research, University of Texas School of Public Health, Houston, TX. (2014). Temporal trends in the leading causes of death among a large national cohort of patients with colorectal cancer from 1975 to 2009 in the united states. *Annals of Epidemiology*, 24(6), 411-417. doi:10.1016/j.annepidem.2014.01.005
- U.S. Cancer Statistics Working Group. United States Cancer Statistics: 1999–2014 Incidence and Mortality Web-based Report. Atlanta (GA): Department of Health and Human Services, Centers for Disease Control and Prevention, and National Cancer Institute; 2017. Available at: <http://www.cdc.gov/uscs>.
- U.S. Department of Health and Human Services: Food and Drug Administration. (2017). What is a Dietary Supplement? <https://www.fda.gov/aboutfda/transparency/basics/ucm195635.htm>
- Van der Geest, L., Lam-Boer, J., Koopman, M., Verhoef, C., Elferink, M., & De Wilt, J. (2015). Nationwide trends in incidence, treatment and survival of colorectal cancer patients with synchronous metastases. *Clinical & Experimental Metastasis*, 32(5).
- Ventura Marra, M., & Boyar, A. P. (2009). Position of the American Dietetic Association: Nutrient supplementation. *Journal of the American Dietetic Association*, 109(6), 2073- 2085. doi: 10.1016/j.jada.2009.10.020
- Wactawski-Wende, J., Kotchen, J. M., Anderson, G. L., Assaf, A. R., Brunner, R. L., O'sullivan, M. J., ... & Prentice, R. L. (2006). Calcium plus vitamin D supplementation and the risk of colorectal cancer. *New England Journal of Medicine*, 354(7), 684-696.
- Wang, YM., Zhou, QY., Zhu, JZ. et al. (2015). *Digestive Diseases and Sciences*; 60:1889. <https://doi.org/10.1007/s10620-014-3518-3>
- Whiting S.J., Vatanparast H., Taylor J.G., Adolphe J.L. (2010). Barriers to healthful eating and supplement use in lower-income adults. *Canadian Journal of Dietetic Practice and Research*, 71(2), 70-76. doi:10.3148/71.2.2010.70
- Young, S. (2014). Healthy Behavior Change in Practical Settings. *The Permanente Journal*, 18(4), 89–92. <http://doi.org/10.7812/TPP/14-018>
- Zhang, S. M., Moore, S. C., Lin, J., Cook, N. R., Manson, J. E., Lee, I. M., & Buring, J. E. (2005). Folate, vitamin B6, multivitamin supplements, and colorectal cancer risk in women. *American journal of epidemiology*, 163(2), 108-115.