Characterizing patient understanding of diet, exercise, and cancer risk

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Dedication

I would like to thank my husband, Nathan, for his constant encouragement and relentless reminder that with “one foot in front of the other I would eventually get there”. I would also like to thank my closest classmates, co-misery made our work much less painful. Lastly, thanks to Mom and Dad, it may be late, but thank you for helping me with all of my middle school science fair projects.
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Introduction

Approximately 11 years ago, the World Cancer Research Fund (WCRF) and the American Institute of Cancer Research (AICR) published a report discussing food, nutrition, and the prevention of cancer. A decade later, a second expert report was published. In both reports experts reviewed the literature and developed recommendations for diet in cancer prevention. In the first report the panel was careful to maintain recommendations in agreement with those made for the prevention of coronary artery disease, the panel also considered ways to implement such recommendations (Summary: food, nutrition and the prevention of cancer: a global perspective / World Cancer Research Fund; American Institute for Cancer Research, 1997). This report highlighted foods most likely to reduce or increase the risks of specific cancers (Glade, 1999). They determined the most sensible approach to the prevention of cancer in the developed world was by the prevention and cessation of smoking along with dietary and associated means such as maintaining physical activity and an appropriate body mass (Glade, Summary: food, nutrition and the prevention of cancer: a global perspective / World Cancer Research Fund; American Institute for Cancer Research). These measures were supported again in the second expert report which highlighted recommendations for maintaining a lean body mass, being physically active as part of every day life, avoidance of sugary drinks, eating mostly foods of plant origin, limiting intake of red meat, limiting alcoholic drinks, limiting consumption of salts, avoiding moldy cereals, aiming to meet nutritional needs through diet alone, and breastfeeding children ("Food, nutrition and the prevention of cancer: a global perspective / World Cancer Research Fund in association with American Institute for Cancer Research", 2007). This report also emphasized that obesity may be the cause of several cancers ("Food, nutrition and the prevention of cancer: a global perspective / World Cancer Research Fund in association with American Institute for..."
Despite this evidence, obesity trends and cancer incidence continue to increase (Chandler, 2006).

Industrialization and urbanization have largely influenced diet, physical activity, and behavior. These areas typically have developed increased consumption of energy dense foods high in meat products, milk, total fats, and sugar while having decreased consumption of fresh fruits and vegetables ("Food, nutrition and the prevention of cancer: a global perspective / World Cancer Research Fund in association with American Institute for Cancer Research", 2007). Additionally, physical activity levels have decreased in these areas ("Food, nutrition and the prevention of cancer: a global perspective / World Cancer Research Fund in association with American Institute for Cancer Research"). As a result, high income countries and urbanized and industrialized areas of middle and low income countries have increased rates of colorectal cancers and hormone related cancers such as breast, endometrium, ovary, and prostate ("Food, nutrition and the prevention of cancer: a global perspective / World Cancer Research Fund in association with American Institute for Cancer Research"). It is speculated that the tendencies for these cancers largely reflect dietary changes of increased fat, decreased fiber, and decreased fruit and vegetable consumption (Austoker, 1994). In the United States, accumulating data indicates approximately one-third of over 500,000 cancer deaths can be attributed to diet and physical activity habits, mainly being overweight and obesity (Kushi et al., 2006). Certainly, it is important to recognize prospective preventive measures and diet and physical activity behaviors appear to be very significant factors in reducing cancer risk. The implementation of dietary change is no small task, in addition to the WCRF/AICR recommendations for public health and individual’s, the American Cancer Society (ACS) has published updated 2006 Nutritional and Physical Activity Guidelines to advise health professionals and the general public about dietary
and other lifestyle practices that reduce cancer risk (Kushi et al.). Since health professionals working in primary care are most inclined to address preventive dietary, physical activity, and lifestyle factors, these guidelines require the mindfulness of physicians, nurses, dietitians, nurse practitioners, and physician assistants alike when assessing a patient’s health.
Research Aims and Objectives

It is without a doubt that many people are interested in diet and fitness behaviors that will guarantee them improved health. This is apparent by the number of diet and fitness products that fill supermarket shelves and advertise themselves in commercials and magazines. As health care providers, it is important that we help patients sort through the overwhelming amounts of information and take part in activities that will truly make a difference in their lives. Since patient’s are likely to discount the value of counseling for a risk factor that may not lead to an immediate clinical problem, it is important to gain a better understanding of the patient’s knowledge of diet, physical activity, and cancer.

In order to further a commitment to nutritional and fitness counseling in the promotion of cancer prevention in primary care, we must be able assess gaps in patient understanding of public health information. Several studies have examined the nutritional knowledge and attitudes of physicians and members of the general public, but to my knowledge few have explored patient understanding of diet, physical activity, and cancer. This information could allow primary care clinicians to better focus counseling efforts. We aim to characterize patient understanding of cancer risks in relation to diet and physical activity with an objective of identifying barriers and misconceptions.
Literature Review: Implementing an intervention in Primary Care: A Discussion of the role of Nutrition and Fitness in the Prevention of Cancer

Preface

In 2005, the Centers for Disease Control and Prevention (CDC) estimated 963.3 million visits were made to office-based physicians, an average of about 331 visits for every 100 persons, with about one-quarter of all visits to general and family practice physicians (Cherry, Woodwell, & Rechtsteiner, 2007). An estimated, 573.2 million office visits were made to primary care specialist (Cherry, Woodwell, & Rechtsteiner). These statistics show the there are many opportunities for primary care clinicians to initiate dietary and fitness intervention. The role of primary care in dietary intervention involves assessing diet, advising adjustments, and addressing barriers that patients have towards making dietary changes directly or indirectly through referral to specialist such as dietitians (Sciamanna et al., 2002). In the same way, primary care health providers are in a key position to assess physical activity levels of both the general population as well as those considered at high risk, mainly those with chronic disease (Douglas, Torrance, van Teijlingen, Meloni, & Kerr, 2006). These opportunities exemplify the importance of having primary care providers address the American Cancer Society’s (ACS) guidelines on nutrition and physical activity and why efforts directed toward prevention are so critical. Several studies have assessed the current attitudes and practice behavior of primary care physicians regarding nutritional counseling (Kushner, 1995) and barriers such as lack of time, adequate nutrition training, resources, negative perceptions of effectiveness of counseling, and uncertainty about guidelines have come to light (Olendzki, Speed, & Domino, 2006). Similar barriers, lack of time, lack of financial incentive, inadequate training, and insufficient training materials, exist for physical activity counseling (Douglas, Torrance, van Teijlingen, Meloni, &
Kerr). This review aims to examine the effectiveness of appropriate nutrition and physical activity therapies in cancer prevention as well as the usefulness of implementing interventions directed towards cancer prevention in primary care.

**Barriers to Cancer Prevention in Primary Care**

Health care providers face many challenges in eliciting effective nutritional intervention in primary care. As mentioned, research suggests that clinicians have difficulty addressing diet due to lack of time, lack of knowledge, lack of confidence, and poor patient compliance (Moore, Adamson, Gill, & Waine, 2000). The complexity of obesity provides yet another challenge. Whereas nutritional counsel for certain periods of life, such as pregnancy, infancy, and the elderly are readily addressed by primary care, people falling outside of these categories are sometimes viewed as a low priority (Truswell, 1999). In addition, in Western society where food is abundant and it is easy to get places and do things without much physical activity, primary care providers alone cannot be expected to cure all those who are overweight or obese (Truswell, Hiddink, & Blom, 2003). The obesity epidemic is analogous to cigarette smoking, individuals themselves must take responsibility along with the messages that society allows in regards to its magnitude (Truswell, Hiddink, & Blom). However, clinicians must realize that obesity is much easier to prevent than cure, and primary care providers can do their part with regular patient weighing, body mass index (BMI) checking, and confrontation of obesity, diet, and exercise (Truswell, Hiddink, & Blom). Healthy People 2010 objectives state “Primary Care providers are well positioned in the health care system to provide preventive services, including nutrition screening and assessment, referral, and counseling” (U.S. Department of Health and Human Services, 2000). The Healthy People 2000 objectives called on primary care providers to
increase the number of patients of whom they provide nutritional assessment and counsel and/or referral to greater than 75% (Calfas, Zabinski, & Rupp, 2000). Giving patients their support is simple and easy to do and can lead to more organized and detailed advice through referral to dietitians and nurses trained in the field (Moore, Adamson, Gill, & Waine). As discussed by Truswell et al., *Nutrition guidance by family doctors in a changing world: problems, opportunities, and future possibilities*, “the doctor’s role is to know the principles of the recommended diets for major diseases and for general health” (2003). In this manner, simple advice can be given based upon general information the patient gives in regards to their current dietary and physical activity habits. For example, with a patient that is noticed to be gaining weight from visit to visit, it is important to both confront the patient about their weight gain and to ask what their diet consists of and what types of regular exercise they engage in. Then, brief advice about bad eating habits and health can be addressed along with discussion of increased fruit and vegetable consumption, water intake, lean meats, and regular exercise.

In a study by Moore et al., *Nutrition interventions by primary care staff: a survey of involvement, knowledge, and attitude*, results seemed to show that dietary advice was often preceded by the assessment of current intake (2002). However, less commonly individuals were counseled on the sensible measure in which they could change their diet (Moore & Adamson, 2002). This demonstrates a gap between assessment and active action to help the patient create a means at which to develop change. Similarly, a study surveying primary care physicians measuring several factors: the frequencies at which they inquire about a patient’s dietary choice, how often they evaluate dietary habits for or against appropriate dietary behavior, how often they offer advice to patients to eat less fat and consume more fiber, how often they offer assistance in making such changes, and lastly the frequency of scheduling dietary follow-up, showed that up
to 54% advised less fat consumption and increased fiber consumption whereas only 42% very often asked about current dietary fat and fiber intake (Sciamanna et al., 2002). Once more deficiencies exist in helping patients understand where they can make a change. Lack of patient counsel is likely due to it being less time consuming to offer brief advise than truly working on deficits that deal with a particular patient. Both studies show that less often patients are receiving tailored counsel by their primary care physicians. The American College of Preventive Medicine (ACPM), the American Academy of Family Physicians (AAFP), the American Academy of Pediatrics (AAP), and the American College of Obstetricians and Gynecologists (ACOG) all support the recommendation of nutritional counseling or dietary advice for patients with at risk of chronic disease (U.S. Preventive Services Task Force, 2003). It is well understood that diets high in fat, low fiber, and low fruit and vegetable consumption can lead to chronic disease such as hypertension and hyperlipidemia. The United States Preventive Service Task Force (USPSTF) has found that in patients without chronic disease (i.e. coronary heart disease or cancer) there is fair evidence that brief, low- to medium- intensity dietary behavioral counsel can produce small to medium changes in the average daily intake of core components of a healthy diet (U.S. Preventive Services Task Force). It has been established that effective interventions combine nutritional education with behavioral oriented counseling because this helps patients acquire the skills, motivation, and support needed to alter their daily eating patterns and food preparation practices (U.S. Preventive Services Task Force).

Many public health initiatives have the objective of bringing about dietary and physical activity change. Although many of the guidelines are similar, perhaps the most focused to reduce cancer risk are the American Cancer Society (ACS) Guidelines on Nutrition and Physical Activity for Cancer Prevention. The ACS publishes these guidelines to advise health care
professionals and the general public about dietary and other lifestyle practices that reduce cancer risk (Kushi et al., 2006). These guidelines include recommendations for community action and individual choices. Individual preventive strategies include maintaining a healthy weight throughout life, adopting a physically active lifestyle, consumption of a healthy diet, with emphasis on plant sources, and limited alcohol consumption. It is likely that practices among primary care providers vary considerably; however it is without doubt that their preventive counsel practices along with the ordering of appropriate tests is critical to cancer prevention (Ashford et al., 2000). Health care providers aware of these guidelines for individual choices would seem to offer the best counsel to patients with at risk behaviors as well as cancer prevention for the general population.

How Does Maintaining Appropriate Body Weight Prevent Cancer?

Many studies have shown that those who have an increased body mass due to being overweight or obese have an increased risk of certain cancers including breast, endometrial, colon, esophageal, gastric, and renal cancers (Carmichael & Bates, 2004; Carmichael, Bendall, Lockerbie, Prescott, & Bates, 2004; Kubo & Corley, 2006; Kushi et al., 2006; Lacey et al., 2006; Lahmann et al., 2004; Majed, Moreau, & Asselain, 2008; Pischon, Lahmann, Boeing, Friedenreich et al., 2006; Pischon, Lahmann, Boeing, Tjonneland et al., 2006). For breast cancer, many epidemiological studies have shown that overweight and obese women have a greater incidence of post-menopausal breast cancer (Carmichael & Bates, 2004). The overall and disease-free survival seems to be decreased in both pre- and post- menopausal obese women with breast cancer (Carmichael, Bendall, Lockerbie, Prescott, & Bates, 2004). In a study by Majed et al. comparing breast cancer risk and optimal body size indicator cut points, those patients with a
body mass index (BMI) value of 25kg/m² and greater had poorer breast cancer prognosis (Majed, Moreau, & Asselain, 2008). The exact mechanism for the increase risk of breast cancer in obese women is not fully understood. Largely, the scientific speculation has revolved around the peripheral aromatization theory, which asserts that since fat cells synthesize estrogen that causes proliferation of breast epithelial cells, being overweight or obese causes greater proliferation of breast tissue (Carmichael & Bates). This is most pronounced in post-menopausal women who are no longer producing estrogen from their ovaries. Proliferating cells are most inclined to error, which if not corrected, can lead to malignant tumor growth (Carmichael & Bates). Thus, increased body fat provides the body with an increased endogenous supply of estrogen resulting in increased breast epithelial cell proliferation. Another factor may be that obese women with insulin resistance secrete greater levels of insulin-like growth factor (Carmichael & Bates). This too has been shown to stimulate mammary epithelium growth, which has a synergistic effect with estrogen in promoting breast carcinogenesis (Carmichael & Bates). Lastly, it is also possible that overweight and obese women having increased breast size do not notice tumor growth until it is of greater size, contributing to a delayed diagnosis (Carmichael, Bendall, Lockerbie, Prescott, & Bates). Measures to prevent obesity are critical since it is one of the few modifiable factors for the prevention of breast cancer. Endometrial cancer has also been shown to have a positive correlation with increased BMI’s; however, decreased risks of endometrial cancer have also been strongly associated with increased physical activity regardless of BMI (Patel et al., 2008).

Breast cancer and endometrial cancer are not the only cancers to be affected by obesity. The European Prospective Investigation into Cancer and Nutrition (EPIC) analyzed body size and the risk of colon and rectal cancers. They found that in men colon cancer risk was strongly
correlated with body weight, BMI, and waist circumference (Pischon, Lahmann, Boeing, Friedenreich et al., 2006). For both men and women, WHR (waist to hip ratios) were strongly related to colon cancer, being greater than 0.95 in men and greater than 0.80 in women (Pischon, Lahmann, Boeing, Friedenreich et al.). This study suggests a relationship between abdominal obesity and colon cancer (Pischon, Lahmann, Boeing, Friedenreich et al.).

A recent systemic review and meta-analysis comparing BMI and incidence of adenocarcinomas of the esophagus and gastric cardia showed that when evaluating increased BMI versus all adenocarcinomas of the esophagus, there was a homogenously positive association for results stratified by cancer location (Kubo & Corley, 2006). Stronger associations were made for men than women (Kubo & Corley). A suggested mechanism is that those with increased BMI have a higher incidence of gastric reflux and therefore greater risk of developing Barrett’s esophagus, a pre-cancerous condition which changes the epithelium of the esophagus to columnar, replacing normal squamous cell epithelium, making it more likely to develop into adenocarcinoma (Kubo & Corley).

Remarkably, for women all measures of obesity including BMI, body weight, waist circumference, and hip circumference were linked to an increased risk of renal cell carcinoma (Pischon, Lahmann, Boeing, Tjonneland et al., 2006). In contrast, the incidence of renal cell carcinoma in men was highly correlated to a low hip circumference, a measure of abdominal obesity (Pischon, Lahmann, Boeing, Tjonneland et al.). Epidemiological studies also suggest that obesity may be responsible for many cancers of the pancreas, gallbladder, thyroid, ovary, and cervix, and for multiple myeloma, Hodgkin’s Lymphoma, and aggressive prostate cancer (Kushi et al., 2006). Overall, suggested mechanisms for increasing cancer risk are the effects of overweight and obesity on sugar metabolism, immune function, hormone levels including insulin
and estradiol, factors that regulate cell proliferation and growth and insulin-like growth factor-1, and proteins that make hormones such as sex hormones (Kushi et al.).

How Does a Physically Active Lifestyle Prevent Cancer?

It is generally understood that those who participate in regular physical activity have better been able to maintain appropriate body weight and avoid being overweight or obese. Maintaining a physically active lifestyle has also been shown to help reduce the risk of several cancers. Studies have shown that lifetime physical activity results in a decreased risk of breast cancer (Kruk, 2007). This is in accordance with maintaining a healthy body weight to prevent breast cancer. A case-controlled study by Kruk et al. seemed to show that largest effects of reduced breast cancer risk were for women who were physically active between the ages of 14-20. The main hypotheses for why physical activity decreases one’s risk of breast cancer are biological mechanisms affecting endogenous sex steroid hormone production, fat tissue storage, levels of peptide hormones and growth factors, immune function, and the effectiveness of antioxidants (Kruk). Perhaps, the most direct way that physical activity decreases breast cancer risk is through decreased estrogen levels due to decreased body fat (Kruk). Many various studies have shown that women who exercise up to 3-4 hours per week at a moderate to vigorous level, have a 30-40% decreased risk of breast cancer and up to 70% for the most active women (Coyle et al., 2007). A study by Coyle et al. looked at hypermethylation of non-malignant breast tissue and tumor suppressor genes APC and RASSF1A. Due to circulating estrogen levels, these tumor suppressor genes that work to stop tumor development, can be affected by hypermethylation and made ineffective or silenced. This study indicated that lifetime physical activity, physical activity within the last five years, and physical activity within the last one year were all inversely
associated with hypermethylation of tumor suppressor genes APC and RASSF1A (Coyle et al.). This means that those with increased physical activity were less likely to develop breast cancer. This is due to those with regular physical activity having decreased circulating estrogen levels that could otherwise affect the beneficial functioning of these tumor suppressor genes. Although, there is reason to highly consider that increased physical activity would also put one at a reduced risk of endometrial cancer due to the strong relationship between breast and endometrial cancers, the associations between physical activity and endometrial cancer have been less obvious (Friedenreich & Orenstein, 2002).

Several studies have also found associations between physical activity and colon cancer, and to a lesser extent prostate cancer. Friedenreich and Orenstein examined fifty-one studies researching colon and colorectal cancer risk and physical activity. They found that when activity levels were compared among more active subjects in various studies that there was an average of 40-50% reduced incidence of colon and/or colorectal cancer, and up to 70% reduced incidence in some studies contrasting the highest and lowest physical activity levels (Friedenreich & Orenstein, 2002). Colon cancer and physical activity have an inverse dose-response, thus the benefits of exercise for colon cancer risk reduction is best demonstrated with more than 4 hours of exercise per week (Trojian, Mody, & Chain, 2007). Possible biological mechanisms for a reduced risk of colon cancer with physical activity includes decreased gastrointestinal transit time, decreased prostaglandins, and lowered bile acid secretion or enhanced acid metabolism (Friedenreich & Orenstein). Association between physical activity and prostate cancer have been less clear, 15 out of 30 observational epidemiologic studies that found an inverse relationship between high physical activity levels and the occurrence of prostate cancer only had an average of 10-30% risk reduction (Friedenreich & Orenstein). Suggested mechanisms include decreased
levels of testosterone because physical activity increases activity of sex hormone binding-globulin, resulting in lower levels of free testosterone (Friedenreich & Orenstein). Other biological mechanisms involve the regulation of hormones such as insulin, of which regular exercise decreases circulating insulin levels (Friedenreich & Orenstein).

How Does a Healthy Diet with Emphasis of Foods from Plant Sources Prevent Cancer?

Largely, epidemiological data has shown that those with diets rich in fruits and vegetables have a reduced risk several cancers (Chandler, 2006). Evidence for decreased risk of various types of cancer with consumption of fruits and vegetables is strongest for cancers of the stomach, esophagus, mouth and pharynx, colon, rectum, and lung, but studies have also shown associations with cancers of the larynx, pancreas, breast, and bladder (Beliveau & Gingras, 2007). Certainly, increased consumption of fruits and vegetables results in better weight maintenance; however, the benefit of increased fruit and vegetable consumption extends beyond weight control. Fruits and vegetables are great sources of fiber, vitamins, minerals, phytonutrients, and phytoestrogens. There are several suggested mechanisms by which increased fiber alone reduces risks of cancers of the colon and rectum. First, fiber keeps waste moving through the gut by helping retain the water content of the stool and reducing the exposure time of toxins to the colonic lining of the gut (Chandler). Second, research has suggested that the pH lowering effects of fiber may be responsible for preventing the development of colon cancer. This effect is due to the way that dietary fiber is broken down, releasing short chain fatty acids, in particular butyrate which can inhibit abnormal cell division (Peters et al., 2003). In addition, increased fiber intake is associated with lowering the risks of several diseases including diabetes, cardiovascular disease, and diverticulitis (Kushi et al., 2006).
As mentioned earlier, fruits and vegetables also contain a plethora of essential vitamins and minerals as well as non-nutritive bioactive constituents such as phytoestrogens and phytochemicals (Kearney, Bradbury, Ellahi, Hodgson, & Thurston, 2005). It is well understood that in cancer, damaged cells go awry and proliferate uncontrollably. Uncontrolled growth can invade and destroy surrounding tissues. These essential nutrients and natural chemicals can manipulate carcinogenesis, the process in which normal cells become cancer cells. Carcinogenesis is a sluggish event because precancerous cells must accumulate multiple mutations in many genes, the ones that control growth, the ones which resist apoptosis, and those that induce angiogenesis in order to grow and invade a host (Beliveau & Gingras, 2007). The time for all of these events to take place allows a significant opportunity for therapy (Beliveau & Gingras). In addition, the minimal genetic diversity of precancerous cells allows them to be highly susceptible to anti-cancer molecules in comparison to well-developed tumor cells (Beliveau & Gingras). Interestingly, even healthy people have a certain amount of precancerous cells, 30-50% of women have premalignant breast tumors and 40% of men have precancerous cells in the prostate (Beliveau & Gingras). From this it would seem that precancerous cells occur throughout life and that it is only when the system is overwhelmed that tumors develop (Beliveau & Gingras).

The chemopreventive properties of the essential nutrients and natural chemicals in plant-based foods, largely fruits and vegetables, have been discussed to work in two different ways. As discussed earlier, one mechanism is the reduction of damage to DNA. Every organ, tissue, and cell in our body is composed of DNA and free radicals, either from the environment or from dietary associated chemicals, and some metabolites have the ability to damage DNA in cells (Beliveau & Gingras, 2007). Anti-cancer phytochemicals keep this from happening by effecting
how these carcinogens are dealt with by either reducing their carcinogenic effect or increasing their excretion from the body (Beliveau & Gingras). Diets rich in cruciferous vegetables lead to high levels of glucosinolates, an unusual phytochemical which through the process of glucosinolate hydrolysis forms isothiocyanates (Talalay, 2000). Specifically, isothiocyanates inhibit tumor formation by decreasing the genetic damage caused by free radicals (Beliveau & Gingras). Isothiocyanates compete with metabolic activation of environmental carcinogens requiring the addition of oxygen and subsequently forming intermediates which can react with DNA, RNA, and protein causing miscoding leading to mutations (Hecht, 1999). Other phytochemicals change the host’s defense mechanisms so that the host is better able to protect against DNA damaging molecules (Beliveau & Gingras). For example, the ability of phytochemicals of the genus Allium, found in garlic and citrus fruits, have been shown to reduce the oncogenic potential of carcinogens (Beliveau & Gingras). Specifically, alfatoxin B1 is a common contaminant of foods and is known to be a very potent hepatocarcinogen (Guyonnet, Belloir, Suschetet, Siess, & Le Bon, 2002). These compounds have been shown to be able to modify cellular events involved in the initiation and promotion steps of carcinogenesis (Guyonnet, Belloir, Suschetet, Siess, & Le Bon). This means garlic consumption is an important tool for the prevention of alfatoxin B1 carcinogens (Guyonnet, Belloir, Suschetet, Siess, & Le Bon). Genestein isoflavone is a metabolite of soy and has been shown to have chemotherapeutic and chemoprotective potential through several mechanisms including apoptosis induction (Kumi-Diaka, Saddler-Shawnette, Aller, & Brown, 2004). Overall, the protective effects these essential nutrients and natural chemicals include some are antioxidants, some may prevent DNA damage, some support DNA repair, some suppress the expression of oncogenes, some stimulate growth factors, and some affect hormone levels and the immune system (Michels, 2005).
Another way in which phytochemicals prevent cancer is through the tumor microenvironment. For example, epigallocatechin-3-gallate (EGCG), a polyphenol found in large quantities in green teas, potentially inhibits endothelial growth factor 2, which is key in tumor angiogenesis (Beliveau & Gingras, 2007). Tumor angiogenesis the ability of the tumor cell to induce blood vessel development to help support its own growth. Other phytochemicals, such as phenolic acid found in high quantities in strawberries and raspberries, and anthocyanidin, which are abundant in blueberries, also inhibit endothelial growth factor two. Another way in which the tumor microenvironment is affected is through the anti-inflammatory properties of phytochemicals. Mounting evidence shows that the western diet high in fats, starches, sugars, saturated fats and trans fatty acids, and low in fiber, fruits, vegetables and healthy fats such as monounsaturated fats and polyunsaturated fats, promote inflammation. Phytochemicals help reduce inflammation. Increased inflammation is particularly prominent in cancers of the colon, breast, breast, and lung (Giugliano, Ceriello, & Esposito, 2006). Unlike mechanisms such as COX 2 inhibitors, medicines that reduce inflammation, the anti-inflammatory properties of fruits and vegetables are such that they do not have secondary harmful side effects. Importantly, studies have shown that it is often not just one isolated dietary factor, for example vitamin E or vitamin C that shows an overall cancer risk reduction, but the molecular interactions of many various nutrients (Milner, 2006).

It is also worth mentioning some foods that have been found to increase the risk of certain cancers. Specifically, studies have show associations between the consumption of red meats and processed meats and colon cancer (Norat, Lukanova, Ferrari, & Riboli, 2002; Sandhu, White, & McPherson, 2001; Skjelbred et al., 2007). An increased ratio of the consumption of red meat compared to the consumption of fruit, berries, and vegetables has shown a greater risk of
developing colorectal carcinomas and adenomas (Skjelbred et al., 2007). The biological mechanisms associated include carcinogenic agents such as nitrogen compounds, polycyclic aromatic hydrocarbons, and heterocyclic amines (HCAs) (Sandhu, White, & McPherson, 2001). These studies support recommendations to maintain a diet low in red meats and processed meats.

How does Limiting Alcoholic Beverages Prevent Cancer?

In a study comparing the joint risks of alcohol and smoking across cancer sites, combined activity leads to 10-25% greater risk of cancers of the oral cavity and pharynx compared to those of the larynx and esophagus (Baron, Franceschi, Barra, Talamini, & La Vecchia, 1993). Mechanisms being direct contact with alcohol making the oral mucosa particularly susceptible to carcinogens in cigarette smoke and the increased time of particles to deposit in this region (Baron, Franceschi, Barra, Talamini, & La Vecchia). Nevertheless, the single effects of alcohol and tobacco carcinogens have also been linked to cancers of the esophagus, larynx, pharynx, and to a smaller extent gastric cardia (Zeka, Gore, & Kriebel, 2003). The European Prospective Investigation into Cancer and Nutrition found both a lifetime and baseline increased risk of colorectal cancers, accordingly 23% and 26% increased risk, for alcohol intakes of 30-59.0g/day as compared to0.1-4.9g/day (Ferrari et al., 2007). Animal models have shown that some of the mechanisms associated with alcohol carcinogenesis may be due to metabolites such as ethanol dehydrogenases, a known carcinogen (Ferrari et al.). Acetaldehyde is the resulting metabolite and has been found to be in large amounts in the colon after drinking alcohol and may result in gene mutations and cellular injury (Ferrari et al.). Medium association between alcohol and breast cancer with a 10% increased risk for women who have one drink a day compared to nondrinkers (Ellison, Zhang, McLennan, & Rothman, 2001). Possible mechanisms relating
alcohol consumption to breast cancer include increases in circulating estrogens or other hormones, reduction in folate levels, or a direct effect of the metabolites of alcohol (Kushi et al., 2006).

What are Effective Nutritional and Fitness Interventions for Cancer Prevention?

Cancer incidence has long been discussed as a reflection of both our genetics and environment. We cannot control our genetics, but we can affect our environment. With clear evidence that obesity, physical fitness, fruit and vegetable consumption, and alcohol use affects cancer risk it is apparent that healthy eating and lifestyle behaviors are the second most controllable factors, next to eliminating tobacco abuse, in preventing cancer. For many, including the World Cancer Research Fund, American Institute of Cancer Research, and the American Cancer Society, the next logical step in cancer prevention is to change poor dietary and lifestyle habits. Importantly, the question arises of how prevention can be implemented in primary care. Several studies have tried to assess effective intervention measures that affect diet and exercise. Some research has been focused upon implementing diet and exercise behavior change specifically for cancer prevention.

A 2007 study from McCarthy et al., Fighting cancer with fitness: Dietary outcomes of a randomized, controlled lifestyle intervention in healthy African-American women, examined a controlled lifestyle change intervention within a culturally community-based program (McCarthy, Yancey, Harrison, Leslie, & Siegel, 2007). In eight weekly sessions, the results showed that those who received instruction in nutrition education promoting a low fat, complex carbohydrate rich diet and instruction of a balanced exercise routine with a large emphasis placed on the cancer protective benefits of increased fruit and vegetable intake had significant change in
their dietary habits. Both groups received sessions involving topics that explored ethnic
disparities in cancer incidence and outcomes. They found the intervention group to have an
increased dietary fiber intake from an average of 14.4 g/day to 16.1g/day. In addition, the total
fruit and vegetable intake of the intervention group increased by 9.5 servings/week. The control
group showed no significant changes in dietary fiber. As discussed by the authors, beneficial
effects on dietary quality were sustained for at least 12 months. Importantly, the intervention
group did not decrease dietary energy intake, but measurably improved the nutritional quality of
their diets. This was consistent with the content of the intervention program. Although the
sample size small, approximately 60 participants, the marked difference between each group
supports the intervention goal. Dietary behavioral changes were significant in those who were
taught appropriate nutrition for cancer prevention. With this data, large-scale implications are
unknown; however the results surely justify further research in this area. In addition, it can be
speculated that motivation for dietary and fitness change in relation to cancer prevention can be a
successful tool for implementation by health care providers. *A Campaign for Better Health*
launched the 5-a day public health message almost 15 years ago. Nevertheless, many factors
influence an individuals likelihood of achieving 5-a day, determinants include: income,
nutritional knowledge, awareness of health impacts of different foods, attitudes towards health
promotion messages, skills and confidence in buying, and preparing and serving fruit and
vegetables.

In an attempt to apply a brief intervention as a model for embedding public health action
in primary care, Kearney et al. had primary care professionals working in a disadvantaged
community issue prescriptions for fruits and vegetables (Kearney, Bradbury, Ellahi, Hodgson, &
Thurston, 2005). The prescriptions offered the patients discounts on fruits and vegetables and
were explicitly linked to a 5-a-day message. Patients were offered advice with emphasis placed on the following information: (1) one-third of cancer and heart disease deaths could be prevented by better diet, (2) the most effective way of preventing cancer is through smoking cessation, with the second most effective strategy being to increase fruit and vegetable consumption, (3) death rates from cancer, heart disease, and stroke could be reduced by 20% if everyone ate five portions of fruit and vegetables a day, (4) within their community (Halton), if everyone ate 5 a day, 150 lives could be saved a year (Kearney, Bradbury, Ellahi, Hodgson, & Thurston). This brief intervention through dietary advice only took one to two minutes. In addition, posters and leaflets were placed throughout the health center as well as a bowl of fruit on the receptionist desk that offered fruit for free. Study evaluation is not yet complete; however, researchers have reported two interesting findings. First, that the patients appear visibly surprised at the magnitude of the relationship between food and health and second, that clinic staff have found the intervention to be very effective way to increase patient’s awareness of the food/health connection. Although weak findings due to the nature of a qualitative-descriptive study, the outcomes present an appealing phenomenon for implementing nutritional counsel, and therefore dietary cancer prevention, in primary care.

A study designed to assess whether a major increase in fruit, vegetable, and fiber intake and a decrease in dietary fat intake would reduce the risk of recurrent and new primary breast cancer did not reduce additional breast cancer events or mortality during a 7.3 year follow up period, but in the intervention group dietary patterns changed substantially (Pierce et al., 2007). It is likely the reason for no change of breast cancer recurrence is from genetic component or dietary habits that had already been in place for many years. However, the effects of the intervention over this time period are significant. The intervention group was randomly assigned
to receive a telephone counseling program supplemented with cooking classes and newsletters that promoted daily dietary targets. The control group received “5-a-day” dietary guidelines, but no specific dietary counsel. At 4 year follow-up, the intervention group had a mean intake change of a 65% increase in vegetable servings, 25% increase in fruit servings, 30% increase in fiber, and a 13% decrease in fat intake (Pierce et al.). The study also measured total plasma carotenoid concentration, a biomarker of vegetable and fruit intake. There was a 73% increase in plasma carotenoid concentrations for the intervention group at 1 year and 43% increase for the intervention group at 4 years (Pierce et al.). These results signify the power of appropriate dietary counsel as opposed to providing information without consult or support.

As many of these studies show, modifying dietary behavior risk is a promising approach to reducing certain cancer risk. In order to effectively implement such interventions, Lopez et al, *Impact of a primary care intervention on smoking, drinking, diet, weight, sun exposure, and work risk in families with cancer*, used principles of health counseling that tailored content of the information to the motivational stage of the respondent (2007). The intervention was successful in reducing several risk behaviors. All patients in the study participated in a face-to-face educational intervention by trained physicians or nurses. Those in the pre-contemplative and contemplative stage of thought about a particular at risk behavior were counseled about the advantages of preventive behaviors and alternatives for disadvantages. Those prepared for action to change there at risk behavior were enrolled in specific programs to control tobacco use, weight, diet, alcohol, etc. and to be trained in specific skills and relapse prevention. Those who were already in an active or maintenance stage were encouraged, with emphasis on achievements and relapse prevention. At risk diet was determined by a food frequency questionnaire. In particular, for at risk diet there was a 30.38% risk people changing behavior for those receiving
the educational intervention (Lopez et al.). Helping patients recognize dietary risks as a component of primary prevention is evident here. Finding ways to effectively integrate such prevention strategies and appropriately addressing dietary goals equally challenging.

A study by Delichatsios et al., *Eat Smart: Efficacy of a Multifaceted Preventive Nutrition Intervention in Clinical Practice*, the authors tested the efficacy of a multifaceted nutrition intervention that included tailored education materials, a low-intensity physician endorsement, and motivational counseling by telephone counselors (Delichatsios, Hunt, Lobb, Emmons, & Gillman, 2001). In their intervention the primary care provider was asked to focus their discussion with patients into a two-part endorsement on one of the food groups of the patient’s preference and their need for improvement. If more detailed counseling was requested by a patient they were referred to study telephone counselors and nutritionist. At the minimum, the clinicians were asked that they stress that diet was an integral part of a healthy lifestyle. The study demonstrated that brief clinician endorsement, together with personalized recommendations and motivational counseling, was effective in increasing fruit and vegetable consumption during a 3-month intervention period.

Implementing physical activity interventions also has shown an overall positive effect on community populations. An overall positive effect on physical activity in the populations studied was seen two trials which both evaluated the usefulness of PACE (Physician-based Assessment and Counseling for Exercise), an individualized theory based minimal intervention strategy aimed at the enhancement of regular physical activity by general practitioner (Van Sluijs, Van Poppel, Twisk, Brug, & Van Mechelen, 2005; Van Sluijs et al., 2005). One study showed a positive effect in the determinants of physical activity behavior such as patient barriers to physical activity, self-efficacy for making time for exercise, self-efficacy for resisting relapse,
and the cognitive and behavioral processes of change (Van Sluijs, Van Poppel, Twisk, Brug, & Van Mechelen, 2005). The other study invited all participants to participate in a 10-minute consultation at which the general health provider discussed the patient’s specific medical conditions along with offering advice to the patient about becoming more physically active (Van Sluijs et al., 2005). The intervention group received the PACE physical activity program materials, a second visit with the provider, and two booster telephone calls from PACE physical activity counselors. The control group simply participated in the initial 10-minute consultation. No statistically significant change in physical activity was seen between groups; however both groups had a statistically significant increase in physical activity duration at one-year follow-up (Van Sluijs et al.). The authors attributed these results to seasonal influence and contamination of the control providers. However, this is not the only study to see an effect in physical activity form advice alone from the primary health care provider. A three-arm trial applied general practitioner exercise referral programs to either a leisure-based exercise program with supervised exercise classes, an instructor led walking program, or physical activity tailored advice only from the general practitioner (Isaacs et al., 2007). They did not find either the leisure-based exercise program or the walking program to be more effective because all groups increased their quantity and intensity of physical activity (Isaacs et al.). All of these studies imply that tailored advice in itself may be effective in encouraging patients to become more physically active.

Summary

Dietary and fitness interventions have proven to be critical facets in the prevention of many cancers. Weight maintenance, physical activity, fruit and vegetable consumption, and moderate alcohol consumption have all been strongly associated with cancer risk. The
interventions discussed provide examples of the effective implementation of dietary and fitness behavior change in patients by health care professionals. It is clear that modifying diet and fitness behaviors through clinician intervention, recognition of unhealthy behaviors and brief support and counsel in making change, is key to cancer prevention.
Methods

Patient Sample

Patients were drawn from two family medicine offices in Northwest Ohio. These sites were selected due to university affiliation. The Toledo site was a medium sized family medicine clinic adjacent from the university hospital. The Maumee site was also a medium sized clinic and adjacent from a community hospital. The two sites shared a group of ten family medicine physicians from the University of Toledo Medical Center.

Survey data was collected during the months of April 2008 through June 2008. Patients were asked to complete the survey while waiting for their appointments to begin, and they were requested to refrain from consulting with others until after the survey was completed. Patients were also asked not to fill out a survey if they had completed one in the past (to prevent multiple people from submitting multiple responses) and/or if they were under the age of 18. Patients were also asked not to participate if they were mentally challenged or had trouble understanding English. The Institutional Research Board at the University of Toledo Health Science Campus approved the study.

Survey

Each patient completed an anonymous, voluntary, self-administered survey. The patients were assured that all responses were confidential. In the first part of the survey, patients were asked their gender, age, height, weight, race/ethnicity, and history of chronic diseases.

In the second section of the survey patients were asked several clinician-patient dialogue questions such as whether they have ever been screened for cancer and if so, when was their last screening and what types of cancers were screened for. They were also asked if during the last
year their doctor or other health care provider had asked them about tobacco use and if they did use tobacco, has their doctor discussed ways to help them quit. Then they were asked if during the last year, has their doctor or other health care provider asked about their dietary habits and if so, has their doctor asked about specific types of foods consumed. Lastly, they were asked if their doctor or other health care provider has asked about physical fitness and exercise habits, and if so has their doctor inquired about a specific amount or duration of exercise.

In the third part of the survey, patients were asked to give their opinion in regards to twenty-four wellness quiz questions, inquiring about diet, exercise, and cancer prevention, where the answer choices were yes, no, and I don’t know. The nutrition and physical fitness questions contained seventeen dietary questions, one question investigating knowledge of effects of tobacco, two questions investigating knowledge of effects of alcohol consumption, and one question investigating knowledge of effects of physical fitness.

The last part of the survey offered three questions, the patient perspective questions, investigating the patient’s own willingness to change. These items were designed to probe a variety of questions in regards to the public health messages that have been put out in regards to diet, physical activity, and cancer prevention. A few questions throughout the survey inquired about heart disease for comparison of a similar public health message that has been well publicized. All questions were pilot-tested for clarity and answers were confirmed based on American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention.

Statistical Analyses

The survey data were coded and then analyzed with both Microsoft Excel and Statistical Analysis Software (SAS) Version 9.1. Descriptive statistics were obtained using the frequency
procedure in SAS. This procedure was utilized to determine the number and percentage of responses to each individual question. Most analyses compared patients with at least one chronic disease to those without a chronic disease. The remaining analyses focused on all patients who completed the survey. Tables and figures were constructed from this data with Microsoft Excel.
Results

A total of 71 patients completed the survey. Demographics and disease profiles of the respondents from each survey are given in Table 1. There is a noteworthy difference in the number of male respondents, 23%, versus female respondents, 77%. Our respondents’ ages had considerable variability, ranging from 19 years old to 79 years old with a mean age of 44. Also, there was a marked difference in the ethnicity/race of our respondents. The majority of the respondents were of white race/ethnicity, 71.0%, whereas 20.3% were of black race/ethnicity, 5.8% were of Latino race/ethnicity, and 2.9% were of other race/ethnicity. Analyses revealed that 55.0% of patients surveyed were living with chronic disease and that 45.0% were not. Of those living with chronic disease, the most common chronic condition was high blood pressure at 22.2%. Only 2.2% surveyed had a known history of cancer.

Table 2 shows survey responses to the clinician-patient dialogue questions regarding cancer screenings, tobacco use, diet, and exercise. Analyses further revealed that 70.0% of patients had been screened for cancer. Cancers screened for included cervical, breast, prostate, and colon cancer. Twenty out of forty-nine patients replied that they had been screened in 2008. When asked about tobacco use, 66.2% replied “yes”, they had been asked about their own use by their health care provider within the last year. Among those who smoked, 55.2% have discussed smoking cessation with their health care provider. Over the last year, 44.3% replied “yes” they have been asked about dietary habits and of those asked, 43.6% replied “yes” they were asked about specific types of foods consumed. Over the last year, 52.9% reported “yes”, their doctor or other health provider has asked about their physical fitness and exercise habits. Of those asked, 44.1% reported that they were asked about the specific amount and duration of exercise. Figure 1
compares the clinician-patient dialogue questions for those with identified chronic disease versus those without identified chronic disease.

The most central purpose of this study was to assess how patients performed with the wellness quiz, inquiring about diet and exercise for cancer prevention. Table 3 shows patients’ answers to the wellness quiz questions. When asked if “maintaining a healthy weight throughout life is important for the prevention of heart disease?” 92.9% responded, “yes” whereas when asked the same question in regards to cancer prevention “maintaining a healthy weight throughout life is important for the prevention of cancer?” 72.9% responded “yes”. Only 33.3% of patient’s responded that “yes”, “thirty minutes of exercise 5 days a week is recommended for cancer prevention”. Most agreed that both fruits and vegetables might help prevent cancer with 75.4% “yes” for fruits and 76.8% “yes” for vegetables. Subsequently, 73.1% agreed that eating whole grains and fiber might help prevent cancer. However, only 50% did not agree, responding “no”, that red meats (beef, lamb, and pork) and processed meats (deli meats) helped prevent cancer. Eighty-four percent (84.1%) agreed that alcohol combined with tobacco use may increase the risk of certain cancers and 60.3% agreed that alcohol alone might increase the risk of certain cancers. When considering the question “Foods marketed as low fat are always low calorie”, 76.5% reported “no”. Less, 48.5% responded, “no” that “poaching meat, poultry, or seafood is less healthy than charcoal grilling”. In regards to vitamins and herbal supplements preventing cancer, accordingly 48.5% and 42.4% reported “yes” and 38.2% and subsequently 41% reported, “I don’t know”. Fifty percent (50%) agreed, “green tea and chocolate may help prevent cancer whereas 45.6% reported, “I don’t know”. Most patients, 60.3%, disagreed that “diets high in reds meats and low in fruits and vegetables helps prevent cancer”. Patients were less decisive about “the benefits of taking fiber supplements and consuming whole grains is the same”, 16.2%
reported “yes”, 45.6% reported “no”, and 38.2% reported “I don’t know”. And whereas a majority of respondents, 82.1%, agreed that decreasing dietary saturated fats is important for the prevention of heart disease, only 55.9% agreed similarly for the prevention of cancer. Lastly, 62.7% of respondents thought fat should be less than 30% of total calories in one’s diet, 35.8% reported “I don’t know”. Figures 2 and 3 show results from patient responses to the wellness quiz. Figure 2 comparing similar questions for the prevention of heart disease and cancer. Figure 3 comparing patient “best response” between those with identified chronic disease versus those without identified chronic disease. “Best response” has been utilized in Figure 3 to exemplify the response that shows the greatest understanding diet and exercise behavior for cancer prevention.

The patient perspective questions, shown in Table 4, were developed to help determine patient willingness to change behavior for better health. When asked, “Would you consider exercising regularly if it added five healthy years?” approximately, eighty-one percent (81.8%) responded “yes”. Sixty-six percent (66.2%) responded “yes” they would change their diet and their families diet if they had better understanding of dietary guidelines for cancer prevention. Frequencies for these two questions were compared between those with identified chronic disease and those without and are shown in Figure 4.
Discussion

To our knowledge this is one of the few studies exploring patient knowledge of how diet and physical activity affects cancer risk and prevention. Our results indicate that there are some deficits in patient nutritional knowledge regarding cancer prevention. With an overwhelming amount of information advertised to the general public as “healthy” each day it is not surprising that many people lack clear answers. This is why it is so important that patients and clinicians discuss tobacco use, diet, and exercise. Clinician assessment of patient tobacco use has been well studied and the dangerous effects of cigarette smoking have been well publicized. Second to smoking cessation, diet and exercise behavior have been shown to be the next most controllable factors in cancer prevention (Kushi et al., 2006; Summary : food, nutrition and the prevention of cancer : a global perspective / World Cancer Research Fund ; American Institute for Cancer Research, 1997). Our study brings to attention the importance of communication about diet and exercise between clinicians and patients. In particular, we found that only 42.7% of patients have been asked about their diet, 41.5% about specific types and amounts of food, 51.5% about exercise habits, and 45.6% about the type of exercise they participate in. Reasons for this clinician-patient gap are attributed to barriers such as a lack of time, lack or resources, and lack of knowledge or confidence in discussing issues related to diet and exercise (Kushner, 1995). Interestingly, of the 42.7% of patients asked about dietary habits within the last year, only 41.5% were asked to divulge greater detail about the specific types of foods they were eating. This information supports previous studies which show that even when clinicians ask about dietary habits, they are not always fully assessing or addressing specific diet issues with an active plan which patients can adopt (Sciamanna et al., 2002). Secondly, of the 51.5% of patients asked about their exercise habits within the last year, only 45.6% were asked about a specific amount
or duration of exercise. Again this seems to show a lack by clinicians to fully encompass a patient’s reason for poor exercise habits or ability to aid in the development of strategy for the patient to work towards for improved exercise under the clinician’s guidance.

Interestingly, patients with identified chronic disease reported a greater frequency of “yes” responses, 81.1% versus 58.1%, to whether their doctor has every screened them for cancer when compared to patients with no identified chronic disease. In 2005, those with one or more chronic conditions made 52.7% of patient’s office visits (Cherry, Woodwell, & Rechtsteiner, 2007). Diagnostic or screening services were ordered at 87.1% of the visits (Cherry, Woodwell, & Rechtsteiner). From our results and those of the National Ambulatory Medical Care Survey, it can be reasoned that patients with identified chronic disease receive more optimal preventive medical care. This is likely a result of increased patient visits creating a greater continuum of clinician-patient dynamics. To further support clinician efforts to discuss dietary and exercise habits with patients, our research has found that 50% of patients with identified chronic disease have discussed dietary habits and 48.3 % have discussed specific types of foods eaten. This is compared to patients without identified chronic disease who only discussed dietary habits with their clinician 36.7% and only divulged greater information such as the types of the foods they eat 37.5% of the time. Although the number of patient visits, as discussed above, likely affects this data as well it is also worth mentioning that many chronic conditions warrant greater dietary assessment. Patients with chronic diseases such as hypertension, hyperlipidemia, diabetes, chronic kidney disease, and many other conditions require increased dietary counsel efforts from clinicians, which are supported by our data. Incongruously, patients with chronic disease status did not similarly effect clinician assessment of physical fitness and exercise habits. However, patients with identified chronic disease did
report a greater frequency, 53.1%, compared to those without identified chronic disease, 36%, about their own clinician’s assessment of the specific amount and duration of exercise they participate in. This information also lends itself to those with identified chronic disease having a greater continuum of care from their clinician with more specialized clinician assessment due to the state of their chronic disease.

Data gathered from respondents’ answers to the wellness quiz showed some noteworthy information largely demonstrating a lack of understanding of how diet and exercise behaviors affect cancer risk. For example, most people surveyed, 94.1%, agreed that maintaining a healthy weight throughout life is important for the prevention of heart disease, but only 70.6% agreed similarly that maintaining a healthy weight throughout life is important for the prevention of cancer. In comparison with strong messages that have been publicized and discussed regarding heart disease, it would appear that the message of weight maintenance for the prevention of cancer has not had as strong of an impact. Perhaps this is because not all cancer types are related to obesity; however, several prominent cancers including breast cancer (especially in post-menopausal women), renal cancer, colon and rectal cancer, endometrial cancer, and esophageal cancer are clearly associated with an increased risk (Carmichael & Bates, 2004; Carmichael, Bendall, Lockerbie, Prescott, & Bates, 2004; Kubo & Corley, 2006; Kushi et al., 2006; Lahmann et al., 2004; Majed, Moreau, & Asselain, 2008; Patel et al., 2008; Pischon, Lahmann, Boeing, Friedenreich et al., 2006; Pischon, Lahmann, Boeing, Tjonneland et al., 2006). Several other cancers have also shown possible associations to obesity, although evidence has not been as clear, these include prostate, thyroid, ovarian, cervix, gallbladder, multiple myeloma, and Hodgkin lymphoma (Kushi et al., 2006). It is important the patients in primary care understand that healthy weight maintenance, maintaining a BMI at or below 25kg/m², is important for
Another question which compared cancer prevention to the prevention of heart disease, inquired about diets low in saturated fats. Eighty-two percent (82.1%) of patients surveyed agreed that diets low in saturated fats are important for the prevention of heart disease, whereas only 55.9% agreed similarly for the prevention of cancer. There is some evidence that certain types of fat, such as saturated fat, may increase cancer risk. In particular some studies have shown an increase risk of developing prostate cancer (Meyer, Bairati, Shadmani, Fradet, & Moore, 1999) or greater risk of recurrence of prostate cancer following prostatectomy for those with diets high in saturated fats (Strom et al., 2008). Other studies have found no difference between types of fat, such as saturated fat versus monounsaturated fat, and prostate cancer risk (Kristal, Cohen, Qu, & Stanford, 2002) or strong evidence to suggest an association between prostate cancer and dietary fat whatsoever (Crowe et al., 2008). Overall, the research regarding dietary saturated fats and prostate cancer risk is mixed; however, it is without doubt that dietary fats contribute to obesity. As discussed earlier, obesity and being overweight are clear risk factors for cancer. Although this question shows some weakness since dietary saturated fat intake and cancer risk is not clear, it does show patient understanding of diet and cancer risk compared to diet and risk of heart disease. This again exemplifies the difference in understanding of risk factors for cancer compared to heart disease. Thus, it is critical that health care providers counsel patients about healthy diets and exercise not only for the prevention of heart disease, but also for the prevention of cancer.

Most respondents seemed very aware that eating certain fruits, vegetables, and whole grains (75.7%, 77.6%, and 73.9% accordingly) might help prevent cancer. Perhaps this reflects
the “5-a day” message publicized by *Produce for a Better Health Foundation* for the past 15 years, healthy eating programs initiated in schools, and daily requirements listed on food packaging. Due to the great value that fruit, vegetable, and whole grain consumption has in reducing cancer risk, it is very encouraging that that patients survey responded very well. It is estimated that 20% or more of all cases of cancer can be prevented with diets having substantial and varied amounts of fruits and vegetables ([*Summary : food, nutrition and the prevention of cancer : a global perspective / World Cancer Research Fund ; American Institute for Cancer Research*, 1997]).

Those surveyed seem to be less sure of the exercise requirements for cancer prevention, 53.7% responded, “I don’t know”. This reflects yet another gap in patient understanding for cancer prevention. Physical activity, a relative factor in weight maintenance, has been found to have significant effects on cancer risk reduction (Friedenreich & Orenstein, 2002; Lee, 2003). Specifically, strong associations have been made for physical activity levels versus colon and breast cancer. Fifty different studies examining associations between physical activity and the risk of developing colon cancer were compared, and results showed an average of 30-40% risk reduction for highly active individuals compared to sedentary individuals with some studies reporting up to 60-80% risk reduction for the most active individuals (Lee). Similarly, breast cancer risk has also shown an inverse relationship to physical activity levels, especially for women between the ages of 14 and 20 (Kruk, 2007). Greater patient knowledge of cancer risk reduction with increased physical activity may promote more individuals to engage in regular physical activity. As found in our study, there is lack of knowledge about current physical activity recommendations for cancer prevention, and this likely reflects what some studies have shown, a lack of understanding of current recommendations not only by patients, but also by the
health care providers (Douglas, Torrance, Van Teijlingen, Meloni, & Kerr, 2006). Results of a study by Coups et al. show that fewer than one in six participants (15%) were aware that physical activity plays a role in the reduction of colon cancer (Coups, Hay, & Ford, 2008). It is important that with this information health care providers take initiative to understand current physical activity recommendations, especially those for cancer prevention. It is also critical that healthcare providers increase awareness of patient understanding of physical activity and cancer risk reduction.

Interestingly, most patients seemed to understand that alcohol use combined with tobacco use increased the risk of certain cancers. However, patients did not seem as aware that alcohol alone increases one’s risk of certain cancers, in fact, up to 28.8% did not know if alcohol alone increased cancer risk and 9.1% felt that it did not have an effect on cancer risk. This may be a result of well-publicized information that states a moderate amount of alcohol may be beneficial toward the prevention of heart disease. On the contrary, this is not the case in regards to certain cancers such as gastric, laryngeal, colorectal, and esophageal cancers (Baron, Franceschi, Barra, Talamini, & La Vecchia, 1993; Ferrari et al., 2007; Zeka, Gore, & Kriebel, 2003). Patients need to understand alcohol consumption increases certain cancer risks and it is important that clinicians are able to communicate this to their patients.

When comparing patient “best responses” to the wellness quiz questions, those being the response choices that show an understanding of dietary and exercise habits for cancer prevention, patients with identified chronic disease and patients without identified chronic disease answered most questions at a similar frequency. The percent difference for most wellness quiz questions, whether patients had an identified chronic disease or not, ranged from 0.3% to 4% with an average of 2% difference in “best response” for wellness quiz questions. We did not find this
significant. However, three wellness quiz questions did have a significant difference for “best response”. Patients without identified chronic disease did seem to better understand that alcohol alone increases cancer risk, 69%, compared to those with identified chronic disease, 56.8 %. The significance of this is not clear.

Conversely, patient “best responses” regarding red meat consumption and cancer, showed that those with identified chronic disease had a better understanding of diet and cancer prevention. Sixty-two (62.2%) of patients with identified chronic disease chose the “best response” when they disagreed that red meats and deli meats may prevent cancer; whereas, only 37.9% of patients without identified chronic disease disagreed with the same statement. A similar question provoked a similar difference in “best response”. When asked if “Diets high in red meat and low in fruit and vegetables may help prevent colon cancer”, 75.7% of those with identified chronic disease disagreed with the statement whereas only 44.8% of those without identified chronic disease disagreed. Both of these wellness quiz questions seem to show a greater lack of understanding from those without identified chronic disease regarding consumption of red meat and cancer risk. Importantly, some studies have found that an increased daily consumption of all meat or red meat of up to 100g (approximately 3.5 ounces) is associated with a 12-17% increased risk of colon and rectal cancers (Sandhu, White, & McPherson, 2001). Other studies have shown that an increase in red meats and processed meats are associated with an increased risk of colon and rectal cancer, and that where red meat consumption is high, reducing consumption to 70g/week could result in 12.1% risk reduction for men in North America (Norat, Lukanova, Ferrari, & Riboli, 2002). Since the effects of increased consumption of dietary red meat and processed meat and the risk of colon and rectal cancer are still imprecise, it is undecided how clinicians should counsel patients regarding their red meat consumption.
However, it appears that patients with identified chronic disease do have a greater awareness of current dietary information regarding red meat and processed meat consumption and colon and rectal cancer risk. Again, this likely demonstrates increased clinician-patient communication due to chronic disease, especially for chronic conditions that require dietary meat restrictions.

The patient perspective questions showed that most patients agreed, 81.8%, that they would consider regular exercise if it added five healthy years to their lives. No respondents replied “No” to this question. I believe this identifies an area of willingness among patients that could be corrected with further guidance. This may also be identifying further patient barriers such as general knowledge, current economic standing, and fatalistic cancer beliefs. These are issues that deserve further investigational research.

When examining frequencies from the patient perspective question between those with identified chronic disease and those without identified chronic disease, an interesting trend had developed regarding patient feelings towards diet and exercise. In both instances presented, patients with chronic disease had slightly greater interest in changing their habits for better health, a 14.4% increase in willingness to change one’s diet with better understanding of guidelines for cancer prevention and a 11.5% increase in willingness to change one’s exercise habits if it added five healthy years to one’s life. Perhaps this reflects greater willingness due to previous counsel regarding such issues by their healthcare providers, greater awareness of how diet and exercise can affect chronic disease, and an understanding of how living with chronic disease can affect one’s daily life.

The current study has several limitations. The study response rate is low. We did experience much difficulty in getting the medical staff at the offices to consistently abide to the request of handing out surveys when patients checked in for their visit and later found at one
office that surveys were placed out in the waiting room to be picked up by patients themselves instead of interactively presenting the patient with the survey. Given the lack of information about those who refused to participate in the study it is unclear how the low response rate may have affected the results of the study. In addition, self-reported information examining clinician-patient dialogue about diet and exercise may not correspond to actual communication efforts by the patients’ healthcare provider. Also, the population studied was fairly homogenous both by race and age. In addition, several patients did not complete certain questions. Questions missed on a particular survey were not included for the tallied number of responses for a single question; therefore, creating different patient totals for each survey question. Reasons for incomplete questions may be due to lack of patient knowledge regarding a particular question or difficulty in understanding a question prompt; however, this could not be determined.

Strengths of the study include affiliation with the university hospital, which is well known to have superb standards for patient care and research. Additionally, our investigation explores patient awareness of diet and cancer, an area that has not yet been well studied. We have not only added to the general knowledge on the subject, but have also provided a base for the development of stronger questions and improved methodology that may increase survey sample size and the significance of future results. For example, more focused surveys looking at particular aspects from this study, such as exploring patient awareness of physical activity and breast cancer or exploring patient awareness of diet and colon cancer.
Conclusion

With up to 500,000 cancer deaths each year in the United States attributed to poor diet and lack of exercise, it is of utmost importance that primary care clinicians address these issues among all patients (Kushi et al., 2006). Perhaps the most central role of primary care is primary disease prevention. This study has identified an area of patient misunderstanding and lack of knowledge that must be addressed by primary care clinicians to improve upon this premise.

Cancer screening efforts, such as mammography and colonoscopy, are well-established tools in the primary care office. Equally, behavior counseling for tobacco abuse has been a structured part of regular patient follow-up. We feel that patient behavior counseling for poor nutritional and fitness habits should be given higher priority. This requires better medical training of clinicians and greater intervention efforts for patients.

Increasing patient awareness of the protective effects of nutrition and fitness for cancer prevention may encourage individuals to better avoid obesity, make better dietary choices, become more active, and have more sensible alcohol consumption. This may reduce the overall burden of several prominent cancers in the United States. Health care providers should routinely counsel their patients on fitness for cancer prevention according to the American Cancer Society Guidelines on Nutritional and Physical Activity for Cancer Prevention. With increased efforts, the prevention of cancer through diet and physical activity and smoking cessation will not only benefit the individuals being seen in primary care, but also the families and communities of which they live in.
References


Investigation Into Cancer and Nutrition (EPIC). *Journal of the National Cancer Institute*, 98(13), 920-931.


Table 1  
*Characteristics of survey respondents*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total (N=71)</th>
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<tr>
<td>High Blood Pressure %</td>
<td>22.2</td>
</tr>
<tr>
<td>Kidney Disease %</td>
<td>0</td>
</tr>
<tr>
<td>Respiratory Disease %</td>
<td>7.7</td>
</tr>
<tr>
<td>Stroke %</td>
<td>2.2</td>
</tr>
<tr>
<td>Other %</td>
<td>14.4</td>
</tr>
</tbody>
</table>
**Table 2**

*Clinician-patient dialogue responses*

<table>
<thead>
<tr>
<th>Question</th>
<th>% Yes</th>
<th>% No</th>
<th>% I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your doctor ever screened you for cancer?</td>
<td>70.0</td>
<td>25.7</td>
<td>4.3</td>
</tr>
<tr>
<td>During the last year, has your doctor or other health provider asked about your tobacco use?</td>
<td>66.2</td>
<td>32.4</td>
<td>1.4</td>
</tr>
<tr>
<td>If yes and you smoke, has your doctor discussed ways to help you quit?</td>
<td>55.2</td>
<td>34.5</td>
<td>10.3</td>
</tr>
<tr>
<td>During the last year, has your doctor or other health provider asked you about your dietary habits?</td>
<td>44.3</td>
<td>50.0</td>
<td>5.7</td>
</tr>
<tr>
<td>If yes, has your doctor or health provider asked about the types of foods you eat?</td>
<td>43.6</td>
<td>50.9</td>
<td>5.5</td>
</tr>
<tr>
<td>During the last year, has your doctor or other health provider asked you about your physical fitness and exercise habits?</td>
<td>52.9</td>
<td>44.3</td>
<td>2.9</td>
</tr>
<tr>
<td>If yes, has your doctor or other health provider asked about the specific amount and duration of exercise?</td>
<td>44.1</td>
<td>52.5</td>
<td>3.4</td>
</tr>
</tbody>
</table>
Figure 1. Clinician-patient dialogue responses comparing those with identified chronic disease versus those without identified chronic disease.

Key
A Has your doctor ever screened you for cancer?
B During the last year, has your doctor or other health provider asked about your tobacco use?
C If yes and you do smoke, has your doctor discussed ways to help you quit?
D During the last year has your doctor or health provider asked about your dietary habits?
E If yes, has your doctor or health provider asked about the types of foods you eat?
F During the last year, has your doctor or other health provider asked about your physical fitness and exercise habits?
G If yes, has your doctor or health provider asked about the specific amount and duration of exercise?
### Table 3

**Wellness Quiz responses**

<table>
<thead>
<tr>
<th>Quiz Questions</th>
<th>Yes%</th>
<th>No%</th>
<th>I don’t know%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintaining a healthy weight throughout life is important for the prevention of heart disease?</td>
<td>92.9</td>
<td>5.7</td>
<td>1.4</td>
</tr>
<tr>
<td>Maintaining a healthy weight throughout life is important for the prevention of cancer?</td>
<td>72.9</td>
<td>10.0</td>
<td>17.1</td>
</tr>
<tr>
<td>Using tobacco products increases your risk of developing cancer?</td>
<td>94.3</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Thirty minutes of exercise 5 days a week is recommended for cancer prevention?</td>
<td>33.3</td>
<td>11.6</td>
<td>55.1</td>
</tr>
<tr>
<td>Eating certain fruits may help prevent cancer?</td>
<td>75.4</td>
<td>2.9</td>
<td>21.7</td>
</tr>
<tr>
<td>Eating certain vegetables may help prevent cancer?</td>
<td>76.8</td>
<td>2.9</td>
<td>20.3</td>
</tr>
<tr>
<td>Eating whole grains and fiber may help prevent cancer?</td>
<td>73.1</td>
<td>4.5</td>
<td>22.4</td>
</tr>
<tr>
<td>Red meats (beef, lamb, and pork) and processed meats (deli meat) may help prevent cancer?</td>
<td>14.7</td>
<td>50.0</td>
<td>35.3</td>
</tr>
<tr>
<td>Alcohol consumption combined with tobacco use may increase the risk of certain cancers?</td>
<td>84.1</td>
<td>4.3</td>
<td>11.6</td>
</tr>
<tr>
<td>Alcohol consumption alone may affect the risk of certain cancers?</td>
<td>60.3</td>
<td>8.8</td>
<td>30.9</td>
</tr>
<tr>
<td>Foods marketed as low fat are always low calorie?</td>
<td>10.3</td>
<td>76.5</td>
<td>13.2</td>
</tr>
<tr>
<td>Poaching meat, poultry, or seafood is less healthy than charcoal grilling?</td>
<td>13.2</td>
<td>48.5</td>
<td>38.2</td>
</tr>
<tr>
<td>Vitamins may help prevent cancer?</td>
<td>48.5</td>
<td>13.2</td>
<td>38.2</td>
</tr>
<tr>
<td>Herbal supplements may help prevent cancer?</td>
<td>42.4</td>
<td>16.7</td>
<td>41.0</td>
</tr>
<tr>
<td>Products such as green tea and chocolate may help prevent cancer?</td>
<td>50.0</td>
<td>4.4</td>
<td>45.6</td>
</tr>
<tr>
<td>Diets high in red meat and low in fruit and vegetables may help prevent colon cancer?</td>
<td>2.9</td>
<td>60.3</td>
<td>36.8</td>
</tr>
<tr>
<td>The health benefits of taking fiber supplements and consuming whole grains is the same?</td>
<td>16.2</td>
<td>45.6</td>
<td>38.2</td>
</tr>
<tr>
<td>Three servings per day is the recommended amount of fruit and vegetables for cancer prevention?</td>
<td>43.3</td>
<td>26.9</td>
<td>29.8</td>
</tr>
<tr>
<td>Decreasing dietary saturated fats is important for the prevention of heart disease?</td>
<td>82.1</td>
<td>4.5</td>
<td>13.4</td>
</tr>
<tr>
<td>Decreasing dietary saturated fats is important for cancer prevention?</td>
<td>55.9</td>
<td>10.3</td>
<td>33.8</td>
</tr>
<tr>
<td>Fat should be less than 30% of total calories in your diet.</td>
<td>62.7</td>
<td>1.5</td>
<td>35.8</td>
</tr>
</tbody>
</table>
**Figure 2.** Wellness Quiz responses comparing the prevention of heart disease versus the prevention of cancer
**Figure 3.** Patient “best responses” for cancer prevention: comparing patient responses for those with identified chronic disease versus those without identified chronic disease

<table>
<thead>
<tr>
<th>Key</th>
<th>Question Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Maintaining a healthy weight (%Yes)</td>
</tr>
<tr>
<td>I</td>
<td>Tobacco increases risk (%Yes)</td>
</tr>
<tr>
<td>J</td>
<td>Thirty minutes of exercise 5 days a week (%Yes)</td>
</tr>
<tr>
<td>K</td>
<td>Fruit and cancer prevention (%Yes)</td>
</tr>
<tr>
<td>L</td>
<td>Vegetables and cancer prevention (%Yes)</td>
</tr>
<tr>
<td>M</td>
<td>Whole grains and cancer prevention (%Yes)</td>
</tr>
<tr>
<td>N</td>
<td>Red meats and cancer prevention (%No)</td>
</tr>
<tr>
<td>O</td>
<td>Alcohol combined with tobacco increases risk (%Yes)</td>
</tr>
<tr>
<td>P</td>
<td>Alcohol alone increases risk (%Yes)</td>
</tr>
<tr>
<td>Q</td>
<td>High red meat with low fruit and vegetables and cancer prevention (%No)</td>
</tr>
<tr>
<td>R</td>
<td>Three servings of fruits and vegetables daily for cancer prevention (%No)</td>
</tr>
</tbody>
</table>
Table 4

*Patient perspective responses*

<table>
<thead>
<tr>
<th>Patient Questions</th>
<th>Yes%</th>
<th>No%</th>
<th>I don’t know</th>
<th>I don’t use tobacco</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would you change your diet and your families diet if you had a better understanding of dietary guidelines for cancer prevention?</td>
<td>66.2</td>
<td>13.2</td>
<td>20.6</td>
<td>N/A</td>
</tr>
<tr>
<td>Would you consider exercising regularly if it added five healthy years?</td>
<td>80.9</td>
<td>0</td>
<td>19.1</td>
<td>N/A</td>
</tr>
<tr>
<td>If you smoke cigarettes, would you continue to smoke if each cigarette you smoked took seven minutes off your life?</td>
<td>4.4</td>
<td>17.6</td>
<td>14.7</td>
<td>63.2</td>
</tr>
</tbody>
</table>
Figure 4. Patient perspective responses on diet and exercise comparing patient responses for those with identified chronic disease versus those without identified chronic disease

Key

S Would you change your diet and your family's diet if you had a better understanding of dietary guidelines for cancer prevention?

T Would you consider exercising regularly if it added five healthy years?
Appendix A: Copy of cover letter attached to patient survey

Dear Patient,

We would appreciate your participation in our study to improve your doctor's and other health providers (for example, Physician Assistants, Nurse Practitioners, Nurses, and Midwives) advice to patients about diet. To help do this, they need to understand your views on diet, exercise, and other related health topics. The information you provide will help your doctor's and other health providers' communication with you. We appreciate your completion of this survey.

You are being asked to participate in a research study. Participation is voluntary. We do NOT want you to write your name on this survey. All responses are confidential. If you are uncomfortable answering any of these questions, feel free to skip them. Please do not chat with other attendants in the office until you finish the survey. When finished, please drop your questionnaire in the collection box. If you have completed this survey before or are a minor (under the age of 18), we ask that you do not complete it at this time. If you are mentally challenged or have trouble understanding English, you do not need to complete the questionnaire at this time.

Thank you,

UTMC Physicians
Catherine Churgay, MD
Linda French, MD, FAAFP
Murthy Gokula, MD, CMD
Sanford R. Kimmel, MD
Jyothi Sri Pappula, MD
Kevin A. Phelps, DO
Paul Schaefer, MD, PhD
Thomas J. Tafelski, DO, PhD
Mark A. Weiner, DO
David L. Weldy, MD, PhD

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Allison Koprowski, UT Physician Assistant Student
E-mail: allison.koprowski@utoledo.edu
Appendix B: Copy of patient survey

**Wellness Survey**

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is your gender?</td>
<td>[ ] Male [ ] Female</td>
</tr>
<tr>
<td>2. What is your age?</td>
<td></td>
</tr>
<tr>
<td>3. How tall are you?</td>
<td>[ ] Feet [ ] Inches</td>
</tr>
<tr>
<td>4. How much do you weigh?</td>
<td>[ ] Pounds</td>
</tr>
<tr>
<td>5. What is your ethnicity/race?</td>
<td>[ ] Black [ ] White [ ] Latino [ ] Asian [ ] Other, please specify</td>
</tr>
<tr>
<td>6. What chronic diseases do you have?</td>
<td>[ ] None [ ] Epilepsy [ ] Heart Disease [ ] High Blood Pressure [ ] Kidney Disease [ ] Respiratory Disease [ ] Stroke [ ] Diabetes [ ] High Cholesterol [ ] Other, please specify</td>
</tr>
</tbody>
</table>

Now, while thinking about seeing your doctor or other health provider (Physician Assistant, Nurse Practitioner, Midwife, Nurse, etc.), please mark or fill-in the questions below.

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Has you doctor ever screened you for cancer (Examples: Mammogram, Pap Smear, Colonoscopy, PSA Test)?</td>
<td>[ ] Yes [ ] No [ ] Don’t Know</td>
</tr>
<tr>
<td>If yes, when was your last screening?</td>
<td></td>
</tr>
<tr>
<td>If yes, what type of cancer(s) were you screened for?</td>
<td></td>
</tr>
<tr>
<td>8. During the last year, has your doctor or other health provider asked about your tobacco use?</td>
<td>[ ] Yes [ ] No [ ] Don’t Know</td>
</tr>
<tr>
<td>9. If you have discussed your tobacco use with your doctor, has your doctor discussed ways to help you quit?</td>
<td>[ ] Yes [ ] No [ ] Don’t Know [ ] I don’t use tobacco</td>
</tr>
<tr>
<td>10. During the last year, has your doctor or other health provider asked you about your dietary habits?</td>
<td>[ ] Yes [ ] No [ ] Don’t know</td>
</tr>
<tr>
<td>If yes, has your doctor or other health provider asked you about the specific types of foods you eat?</td>
<td>[ ] Yes [ ] No [ ] Don’t know</td>
</tr>
<tr>
<td>11. During the last year, has your doctor or other health provider asked you about your physical fitness and exercise habits?</td>
<td>[ ] Yes [ ] No [ ] Don’t know</td>
</tr>
<tr>
<td>If yes, has you doctor or other health provider asked about the specific amount and duration of your exercise?</td>
<td>[ ] Yes [ ] No [ ] Don’t know</td>
</tr>
</tbody>
</table>

Now, we would like to know your opinion of the following statements. Please mark the items below.

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. Maintaining a healthy weight throughout life is important for the prevention of heart disease?</td>
<td>[ ] Yes [ ] No [ ] Don’t know</td>
</tr>
<tr>
<td>13. Maintaining a healthy weight throughout life is important for the prevention of cancer?</td>
<td>[ ] Yes [ ] No [ ] Don’t know</td>
</tr>
<tr>
<td>14. Using tobacco products increases your risk of developing cancer.</td>
<td>[ ] Yes [ ] No [ ] Don’t know</td>
</tr>
</tbody>
</table>

Please, continue survey on the other side of the page.
Wellness Survey

15. Thirty minutes of exercise 5 days a week is recommended for cancer prevention.
   [ ] Yes  [ ] No  [ ] Don't know

   [ ] Yes  [ ] No  [ ] Don't know

17. Eating certain vegetables may help prevent cancer.
   [ ] Yes  [ ] No  [ ] Don't know

18. Eating whole grains and fiber may help prevent cancer.
   [ ] Yes  [ ] No  [ ] Don't know

19. Red meats (beef, lamb, and pork) and processed meats (deli meat) may help prevent cancer.
   [ ] Yes  [ ] No  [ ] Don't know

20. Alcohol combined with tobacco use may increase the risk of certain cancers.
   [ ] Yes  [ ] No  [ ] Don't know

21. Alcohol consumption alone may affect cancer risk.
   [ ] Yes  [ ] No  [ ] Don't know

22. Foods marketed as low fat are always low calorie.
   [ ] Yes  [ ] No  [ ] Don't know

23. Poaching (to boil or simmer in liquid) meat, poultry, or seafood is less healthy than charcoal grilling.
   [ ] Yes  [ ] No  [ ] Don't know

24. Vitamins may help prevent cancer.
   [ ] Yes  [ ] No  [ ] Don't know

25. Herbal supplements may help prevent cancer.
   [ ] Yes  [ ] No  [ ] Don't know

26. Products such as green tea and chocolate may help prevent cancer.
   [ ] Yes  [ ] No  [ ] Don't know

27. Diets high in red meat and low in fruit and vegetables may help prevent colon cancer.
   [ ] Yes  [ ] No  [ ] Don't know

28. The health benefits of taking fiber supplements and consuming whole grains is the same.
   [ ] Yes  [ ] No  [ ] Don't know

29. Three servings per day is the recommended amount of fruit and vegetables for cancer prevention.
   [ ] Yes  [ ] No  [ ] Don't know

30. Decreasing dietary saturated fats is important for the prevention of heart disease.
   [ ] Yes  [ ] No  [ ] Don't know

31. Decreasing dietary saturated fats is important for cancer prevention.
   [ ] Yes  [ ] No  [ ] Don't know

32. Fat should be less than 30% of total calories in your diet.
   [ ] Yes  [ ] No  [ ] Don't know

33. Would you change your diet and your family's diet if you had a better understanding of dietary guidelines for cancer prevention?
   [ ] Yes  [ ] No  [ ] Don't know

34. Would you consider exercising regularly (3 to 5 days a week) if it added five healthy years to your life?
   [ ] Yes  [ ] No  [ ] Don't know

35. If you smoke cigarettes, would you continue to smoke if each cigarette you smoked took seven minutes off your life?
   [ ] Yes  [ ] No  [ ] Don't know  [ ] I don't smoke

Please, continue survey on the other side of the page.
Abstract

**Objective:** This study examined patient understanding of cancer risks in relation to nutrition and physical activity with a goal of identifying barriers and misconceptions.

**Methods:** A self-completion survey was used to assess patient understanding of diet, exercise, and cancer risk. Descriptive statistics were obtained.

**Results:** Patients surveyed had a reasonable understanding of weight maintenance and fruit, vegetable, and whole grain consumption for cancer prevention. Patients were less aware of physical activity recommendations and risks associated with alcohol use. Differences between patient groups were seen in patient understanding of colon cancer risk associated with dietary red meat consumption.

**Conclusion:** This study has identified some areas of patient confusion. Greater awareness of nutritional and fitness behaviors for cancer prevention may encourage patients to make better lifestyle choices. Health care providers should routinely inform their patients about dietary and physical activity behaviors that will reduce their risk of developing certain cancers.