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# Risk Perceptions, Worry and Communication as Predictors of Lung, Colon and Skin Cancer-Related Behaviors

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# RISK PERCEPTIONS, WORRY AND COMMUNICATION AS PREDICTORS OF LUNG, COLON AND SKIN CANCER-RELATED BEHAVIORS

By

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# ABSTRACT

In spite of numerous health efforts to reduce cancer prevalence and mortality, current estimates place this condition as the second most deadly disease in the U.S., falling only behind heart disease. To assist health professionals in their attempt to alleviate the burden associated with cancer, this study examines communication, demographic, rational and affective factors that predict involvement in cancer-related behaviors among U.S. adults. In addition, this study explores gender differences among the proposed relationships and tests the applicability of risk-as-feeling hypothesis to cancer-related phenomena.

The study uses the Health Information National Trends Survey data set collected in 2005. The data contains measures related to cancer knowledge, attitudes and behaviors, access to and use of communication channels, risk perceptions, worry and demographic characteristics. A path analysis is employed to test the relationships identified by three hypotheses. These analyses are specific to certain cancers including lung, colon and skin cancers. In addition, these analyses feature a multiple group comparison technique (males versus females).

The main findings include no support for a gender effect on the proposed relationships. Even though several gender effects are encountered for some relationships, the patterns are not common across cancers or predictors. In addition, the results suggest partial support for the risk-as-feeling hypothesis. The hypothesized impact of emotions on reason and the influence of affect on cancer-related behaviors are supported by some of these analyses. Finally, based on the results, this study is able to advance suggestions for the development of a single model across various types of cancers.

In addition, several individual results are of noticeable importance. The control variables, age, race and education are consistent predictors of knowledge and online health information seeking. Worry consistently predicts risk perceptions, regardless of the cancer type. Moreover, worry has the highest coefficient among all predictors of risk perceptions. Almost a third of the variance in cancer-related knowledge, online health information seeking behavior and risk perceptions is attributed to the proposed predictors and the control variables. Predictors, while significant, account for a small portion of the variance in cancer worry or cancer related behaviors.

These analyses provide a deeper understanding of the factors that predict cancer-related knowledge, online health information seeking behavior and risk perceptions. However, the analysis fails to account for the variance in worry and cancer related behaviors. Nevertheless, these findings should

help health communication professionals design and target messages to increase cancer knowledge, online health information seeking and risk perceptions among U.S. adults which may in turn help prevent the onset of cancer.

# CHAPTER I
# INTRODUCTION

## General Considerations

Since 2000, the American Cancer Society and the National Cancer Institute have published an annual comprehensive, authoritative report documenting the status and projected incidence of cancers in the U.S. (ACS(a), 2008). This report emphasizes that cancers have both controllable and uncontrollable risk factors (ACS(a), 2008) and suggests that most individuals increase their chances of developing cancer through their lifestyle choices. Nevertheless, determinants such as age and family history of cancer are potential risk factors that individuals cannot control but influence their chances of developing cancer as well (American Cancer Society: Detailed Guide, 2008; Oncology Nursing Society, 2007). About five to 10 percent of all cancer cases can be attributed to uncontrollable factors such as genetics. The balance, 90 to 95 percent, can be credited to controllable risk factors embedded in the environment or lifestyle (Anand et al., 2008). In terms of lung, colon and skin cancers, the report highlights that individuals can greatly reduce the likelihood of developing these cancers by diminishing behavioral risks such as poor diet, physical inactivity, smoking and excessive sun exposure (ACS(a), 2008; Oncology Nursing Society, 2007).

Researchers suggests that additional factors can impact individuals' involvement in healthy lifestyle habits and subsequently the likelihood of developing cancer. Individuals who actively seek health information and constantly renew and increase their cancer-related knowledge can better understand and detect cancer risks, symptoms and preventive behaviors (Zhu et al., 2000). In addition, they are also cognitively prepared to assess the status of their health and to find resources to reduce or eliminate the influences of negative factors (Chen & Tetsuji (conference-abstract) 2006; Van der Molen, 1999).

Health information seeking behavior and cancer knowledge can also impact individuals' risk perceptions and emotional activity. Active health information seekers tend to have more accurate risk perceptions of disease threat and report lower levels of worry (Lambert and Loiselle, 2007). In contrast, less knowledgeable individuals and passive health information seekers are more likely to report increased stress and worry about the potential of contracting cancer and high levels of pessimism about the likelihood of surviving it (Antoni et al., 2006; Breslow, Sorkin, Frey & Kessler, 1997; Johnson, 1997).

Several health behavioral theories including the protection motivation theory, the health belief model and the extended parallel process model, generally state that individuals who hold lower perceptions of self-efficacy will be less likely to take actions that protect them against disease development (Corner & Norman, 2005; Dillard & Pfau, 2002; Rogers, 1975). In addition, individuals who lack perceived control, a state that can potentially emerge from increased feelings of worries and lack of knowledge, report limited intentions to adopt health protective behaviors. Finally, individuals who have inaccurate risk perceptions and erroneous beliefs about their vulnerability of developing health conditions are less likely to engage in protective actions as well. Consequently, health information seeking behavior, cancer knowledge, risk perception and worry represent important elements that influence people's decision to engage in cancer-protective practices.

This study proposes an analysis of these factors comparing males versus females as the interaction between these elements changes due to different gender characteristics. For instance, research has suggested that knowledge and health information seeking reduce anxiety. However, studies have also indicated that females, compared to males, while more knowledgeable and more active in their health information seeking behavior, reported increased stress and feelings of worry about developing cancer. Thus, it is important to determine how gender can impact individuals' approach to health.

The specific cancers examined in this study include lung, colon and skin (melanoma, in particular) cancer, as they are some of the most prevalent types of cancers. Lung, colon and skin cancers differ largely in terms of the preventability of the disease and the complexity of behavioral risk factors associated with the disease (ACS(a), 2008). These two elements can have important implications on how people perceive cancer risk, how much they worry about it and their likelihood of engaging in cancer-related behaviors (Hay, Coups & Ford, 2006; Sloan, Smith & Taylor, 2003; Montgomery et al., 1989).

Among the three types, lung cancer is considered the least preventable type of cancer and has the highest incidence and death rate among the U.S. adult population. Smoking, its major risk factor, can be considered the most complex risk factor and encounters the largest barrier in terms of its reduction (ACS(a), 2008). Individuals are not very easily convinced to reduce their smoking intake or engage in smoking cessation strategies.

Colon cancer represents a more preventable type of cancer compared to lung cancer (Byers et al. 2002, NCI (a), 2007). Colon cancer is ranked third in terms of incidence and mortality rates (ACS(a), 2008). Its risk and curability are largely dependent on healthy lifestyle habits such as regular physical

activity. Generally, adherence to exercise regiments has yielded more compliance compared to cessation of tobacco use.

Lastly, skin cancer is the most preventable type of cancer among the three (ACS(a), 2008). Its risk and curability level are extremely high. Between melanoma and non-melanoma, the former one is more dangerous, and is addressed in this study. Sun-safe practices and early detection of abnormal moles ensure recovery and survival from melanoma (ACS(a), 2008). The negative impact of excessive sun exposure, the main behavioral risk factor for melanoma, can easily be avoided or diminished through regular sunscreen applications.

Consequently, this study examines differences and similarities in terms of online health information seeking behavior, cancer-related knowledge, worry and risk perception for cancers that have different preventability levels. In addition, it will also explore the relationships between the previously mentioned factors and people's involvement in cancer-related behaviors (positive and negative) that have different complexity levels.

## Problem Statement

Despite numerous efforts to reduce cancer incidence, ensure accurate risk perceptions, enhance knowledge about cancer and increase adherence to cancer protective behaviors, studies suggest that incidence is still fairly high and people continue to have limited cancer knowledge, hold inaccurate risk perceptions and engage in unhealthy behaviors (ACS(a), 2008; CDC-Smoking, 2008, CDC-Leisure Time PA, 2008; NCI Brief 2, 2007). The multitude of cancer awareness campaigns has fallen short of widely lowering cancer incidence and increasing adoption of healthy behavioral practices.

Current cancer estimates indicate that there is a continuous need for health programs to reduce involvement in negative cancer-related behaviors. While the trends in the numbers of cancer deaths have declined in recent times, the current incidence and death estimates are still troublesome (NCHS(a), 2008, MMWR(a), 2008). The American Cancer Society estimated that 1,437,180 new cancer cases were expected to be diagnosed in 2008 (ACS(a), 2008). Moreover, 565,650 individuals were expected to die of cancer, which represented roughly 1,500 people a day (ACS(a), 2008).

This study focuses on lung, colon and skin cancers due to their proliferation in the U.S. population. Considering all cancer types, lung cancer represents the second leading cause of estimated new cancer cases and the leading cause of cancer deaths (ACS(a), 2008). Lung cancer accounts for 15 percent and 14 percent of new cancer cases among males and females respectively (ACS(a), 2008).

Since 2000, lung cancer has consistently accounted for the largest number of cancer deaths, making this condition the most harmful type of cancer (ACS-Overall, 2009).

Colon cancer has recorded a similar negative impact. The most recent estimates indicate that colon cancer represents the third leading cause of estimated new as well as death cases among U.S. adults (ACS(a), 2008). Colon cancer accounts for 10 percent of all new cancer cases among males and females (ACS(a), 2008). While both males and females experience high rates of lung and colon cancers, the American Cancer Society projects higher number of diagnoses among males than among females (ACS(a), 2008).

Finally, skin cancer portrays a different risk profile. This type of cancer accounts for very few deaths among the U.S. population, however, its incidence is relatively high (ACS(a), 2008). The National Cancer Institute indicated that one in 55 individuals will have developed melanoma at some point in their life (NCI-SEER, 2008). Skin cancer, melanoma in particular, is the sixth and seventh leading cause of estimated new cancer cases among males and females respectively (ACS(a), 2008). Males, compared to females, are more likely to be diagnosed with melanoma (NCI-SEER, 2008).

Even though the large majority of deaths and new cases for lung, colon and skin cancer can be prevented through reduction or elimination of behavioral risk factors, individuals continue to engage in negative lifestyle habits. For instance, smoking, which represents the main risk factor for developing lung cancer, accounts for 87 percent of lung cancer deaths (ACS(a), 2008). A great deal of success in terms of decreasing lung cancer incidence and death rates would be achieved by reducing or eliminating tobacco use in the U.S. Nevertheless, it is estimated that approximately 43.4 million U.S. adults smoke cigarettes (CDC, 2009). Cigarette smoking among U.S. adults declined to 21 percent in 2004 but rates have remained relatively unchanged since then.

The five percent gap between male and female smoking has remained unchanged since the mid 1980s as well (MMWR(d), 2007). Research suggests inconsistent patterns of lung cancer development for males versus females depending on the length and quantity of smoking. Some suggest that, among never smokers, females compared to males tend to be more susceptible to developing lung cancer (Freedman, Leitzmann, Hollenbeck, Schatzkin & Abnet, 2008), while other sustain the opposite (Risch & Miller, 2004; Thun et al., 2006). However, the American Cancer Society indicates that women are no more or less susceptible to developing lung cancer compared to men (ACS-Susceptibility to Lung Cancer, 2004). This is supported by Freedman Leitzmann, Hollenbeck, Schatzkin and Abnet (2008) who despite statistical significance, suggested that gender differences were minimal.

The Complete Guide for Nutrition and Physical Activity (ACS(b), 2008) suggests that engaging in moderate to vigorous physical activity on a daily basis can greatly reduce the risk of cancer, especially colon cancer. Approximately 40 percent of all cancer deaths in the U.S. are attributed to lack of physical activity (Byers et al. 2002, NCI (a), 2007). From 2001 to 2005, physical activity increased to approximately 50 percent among males and 47 percent among females compared to the initial 48 and 43 percent among males and females respectively (MMWR(b), 2007). Females showed sharper increases compared to males across all demographic groups (MMWR(b), 2007). Although, relative improvements have been noticed, physical activity is still not part of the daily routine among the general population (MMWR(b) 2007).

Excessive sun exposure and individuals' failure to apply sunscreen are some of the principal behavioral risk factors for melanoma (American Cancer Society: Detailed Guide, 2008). While skin cancer is more common among light-skinned individuals, individuals who are exposed to sun for extensive periods of time are at increased risk for developing this type of cancer (Mayo Clinic: Skin Cancer, 2008). The National Cancer Institute reported that between 2003 and 2005, the percentage of people who used sunscreen fell more rapidly than any previous rising periods (NCI(b), 2007). Among various demographic groups, males used protective measures less frequently compared to females. Specifically, 47 percent of males compared to 65 percent of females used at least one method that protected them against the sun (NCI(b), 2007).

These estimates indicate that cancer continues to represent one of the most prevalent and destructive health conditions. More troublesome, these reports indicate that U.S. adults fail to engage in behaviors that will protect them against this condition. In addition, studies suggest cancer-related behaviors differ by gender category. Females engage in less harmful behaviors compared to males and may, as a result, become less vulnerable to developing or dying from cancer. The gap between males' and females' susceptibility to disease may widen as females hold more positive attitudes towards health compared to males. Females tend to be more knowledgeable about health and engage in more frequent health information seeking behaviors compared to their counterparts (McQueen, Vernon, Meissner & Rakowski, 2008; Lambert & Loiselle, 2007; DiLorenzo et al., 2006, Stewart et al., 2004, Finucane, Alhakami, Slovi & Johnson, 2000).

Health information seeking represents an important behavioral characteristic that generally increases knowledge, helps in the decision making process and enhances adherence to various health recommendations (Lambert & Loiselle, 2007; Case, 2002; Johnson, 1997). Researchers point out that

information seeking behavior represents people's most important venue to gather information and to make informed health decisions (Barnett, Charman, Sizer & Murray, 2004, Lambert & Loiselle, 2007).

In turn, knowledge represents a significant element that influences individuals' adoption or intention to adopt healthy practices as well. For instance, studies indicated a positive association between knowledge of skin cancer and adoption of sun-safe behaviors such as use of protective clothing, sunscreen and sunglasses (Christensen et al., 2007; Stanton, Janda, Baade & Anderson, 2004). Moreover, individuals who were more knowledgeable about cancer risk factors, treatments and preventive behaviors, were more likely to opt for behavioral change towards healthier lifestyles (Christensen et al., 2007).

Historically, researchers found that females reported greater perceived risk towards developing cancer compared to their male counterparts (Dillard, McCaul and Klein, 2006; Rob, Miles & Wardle, 2004). Since perceived risk of a disease is generally associated with willingness and desire to learn more about preventive practices and subsequently engage in those practices, females again have a higher likelihood of engaging in behaviors that are less harmful to their health compared to males (Hay et al., 2007, Stanton, Janda, Baade & Anderson, 2004, Cerully, Klein & McCaul, 2006). Nevertheless, recently, McQueen, Vernon, Meissner & Radowski (2008) indicated that the relationship between gender and risk perception might have changed.

Worry as a component of the health decision process has yielded mixed results. Feelings of worry have been associated with both increased compliance with healthy behaviors and lack of adherence to preventive practices (Berkowitz et al., 2008; Moser et al., 2007; Mullens, McCaul, Erickson & Sandgren, 2004). In addition, studies seem to indicate that even though females are more health aware and generally seek more health information compared to males, they are also more likely to worry (McQueen, Vernon, Meissner & Radowski, 2008).

Preventive efforts against cancer, except for gender-specific cancers, have not really distinguished between males and females' health information needs, knowledge level, risk perception and feelings of worry. Most cancer campaigns have targeted males and females together. This general approach to cancer awareness may not be sufficient to reduce the high rates of cancer incidence and to increase adherence to preventive practices, especially when males and females have reported different health attitudes and behaviors. Baum (2000) concurrently argued that most interventions are "inappropriately generalized" across factors such as gender, age and culture.

Campaigns need to be tailored based on demographic and cultural characteristics but also inclusive of other lifestyle characteristics. It is essential to recognize that gender, age, education and history of cancer are important considerations to any campaign planning but they cannot be directly or easily modified (American Cancer Society: Detailed Guide, 2008; Oncology Nursing Society, 2007; Consedine et al., 2004). In addition to demographic characteristics, other variables such as the health information seeking behavior, knowledge level, emotional activity (e.g. worry, fear, anxiety) and risk perceptions should take a more central role in health research; especially as existing studies have portrayed these factors as well-documented health motivators and central elements in adoption of healthy practices (Lambert & Loiselle, 2007, Consedine et al., 2004). It is essential to consider these elements as they are easier and more likely to change through good campaigning.

Furthermore, a good understanding of the nature and role of worry and risk perception is necessary as these two factors can erroneously increase individuals' perceived negative impact of a disease over another. False impressions of disease severity could potentially lead to incorrect health decisions and harmful health consequences. This is most noticeable among women who fear breast cancer. Even though women experience and die from heart disease and lung cancer at higher rates compared to breast cancer, increased feelings of worry and anxiety associated with developing breast cancer have led women to focus their attention towards reducing their chances of developing breast cancer (ACS(a), 2008). In this process, they have become more ignorant towards their vulnerability towards heart disease and lung cancer (APHA, 2005; Burke et al., 2001). Intense worry or anxiety may deter individuals from taking imperative health actions (Fitzpatrick, 2004).

Taking all these aspects into consideration, this study proposes a gender comparison to test the relationship between online health information seeking behavior, cancer knowledge, cancer risk perceptions and cancer worry and involvement in cancer-related behaviors. The results presented in this study represent an attempt to generate a more thorough understanding of gender patterns related to health behaviors and to contribute to the effectiveness of social marketing and health communication campaigns geared toward shielding adults from developing lung, colon or skin cancer.

## Purpose/Objectives

After reviewing the research on the current prevalence of cancer preventive practices and behavioral risk factors, the communication needs, the cognitive and affective experiences and the cancer projections for 2008, this study proposes two objectives. The first objective is to explore differences and

similarities between the above mentioned factors and their endogenous variables among males and females. The second objective is to investigate differences and similarities among the same hypothesized relationships across three widely different types of cancers.

Through its objectives, this study has important implications for health professionals in their attempt to promote lifestyles that shield individuals from developing cancer. First, the significance of the study is related to the risk perception literature. It intends to shed more light on cancer risk perception based on gender as well as various types of cancers. Most of the research in this area has focused on risk perceptions for gender specific cancers such as prostate cancer for males and breast cancer for females. Fewer studies have examined a combination of cancers or cancers that are not gender specific (McQueen, Vernon, Meissner & Rakowski, 2008; Stark, Bertone-Johnson, Costanza & Stoddard, 2006, Weinstein et al., 2004). In addition, a recent study suggests a potential change in the relationship between gender and risk perception (McQueen, Vernon, Meissner & Rakowski, 2008). More research is needed to determine if such modification occurred.

Second, this study adds to existing research on feelings as part of the health decision making process. People are not cold and rational thinkers when it comes to health issues and death. An emotional reaction accompanies any health diagnosis or health matter (Loewenstein, Hsee, Weber & Welch, 2001, Johnson, 1997). Moreover, even though females, compared to males, are more aware and concerned with their health and more likely to engage in protective behaviors regardless of the cancer, they are also more fatalistic and worried about developing health issues (McQueen, Vernon, Meissner & Rakowski, 2008; Dillard, McCaul & Klein, 2006). More research is needed to explain these variations and to develop ways to lower women's anxieties.

Since health communication represents a complex process that seeks to change a person's physical, psychological and social worlds (Northouse and Northouse; 1998), Neuhauser and Kreps (2008) suggested that health communication is more effective when it reaches people at both the emotional and rational level. Understanding individuals' emotional reactions upon seeking health information and gaining knowledge can help health professionals and campaign planners design health messages that can assist individuals both emotionally and practically in their effort to preserve a disease-free lifestyle.

A third contribution consists of understanding variations in males' and females' involvement in cancer protective behaviors based on cancer preventability and curability. The likelihood of developing cancers with a higher degree of preventability and curability might yield a different behavioral response

compared to cancers that are characterized by low preventability and curability. Thus, this study explores how different cancer aspects might yield compliance with cancer reducing strategies.

Lastly, this study adds depth to the health information seeking behavior and cancer knowledge research by examining their determinants as well as their predictive influence on risk perception, worry and various types of cancer related behaviors across and within gender. The majority of studies have looked at health information seeking behavior or knowledge about breast and prostate cancer and more recently colon cancer screening. Fewer studies compared individuals' health information seeking behavior and knowledge among cancers that have different protective behaviors, that are common across gender groups and that have different preventability and curability levels.

## Organization

The following sections detail the content of this dissertation. Chapter Two reviews the literature related to the prevalence of lung, colon and skin cancers as well as their related behavioral risk factors. In addition, this part highlights the current research on cancer-related knowledge, online health information seeking behaviors, cancer risk perceptions and cancer worries. This section concludes with the theoretical approach and the proposed hypotheses.

Chapter Three outlines the methods used in this study. The samples, represented by three cancer specific data sets, are introduced, along with background details and data collection procedures of the 2005 HINTS, the questionnaire items and the weighting method. This section ends with a discussion of the data analysis techniques used in this dissertation.

Chapter Four presents the study results. This chapter includes three subsections which distinguish between respondents in the three cancer modules. Each subsection begins with a description of the sample and continues with the path analysis summary tables and results. This section focuses on answering the hypotheses identified in Chapter Two.

The final section, Chapter Five, discusses the findings of the study. Results related to gender differences, the risk-as-feeling hypothesis and individual paths are identified and explained. The limitations of the study are also outlined. This section ends with recommendations for future research.

# CHAPTER II
# LITERATURE REVIEW

## Cancer Prevalence and Behavioral Risk Factors

The National Cancer Institute and the American Cancer Society indicated that in 2004, 10.8 million Americans had experienced some type of cancer in their lifetime (ACS(a), 2008). The American Cancer Society projections indicated that approximately one in four adult deaths were due to cancer (ACS(a), 2008, Jemal et al., 2008). Trends in cancer prevalence showed a slight decline for most types of cancers among both males and females (NCI(e), 2005).

Lung cancer is one of the most burdensome kind of cancers in terms of both new cases and deaths (ACS(a), 2008). Approximately 114, 690 males and 100,330 females were projected to be diagnosed with lung cancer and 161, 840 individuals were estimated to die of lung cancer in 2008. This represented roughly 15 percent of all new cancer cases and 29 percent of all cancer deaths. African American males were the most likely group to develop and die from lung cancer (ACS(a), 2008). At the beginning of 2005 there were about 360,081 individuals who had a diagnosis of lung cancer at some point in their lifetime. Of those, 47.8 percent were males and 52.3 percent were females (NCI(f), 2008). Recently, a report of the National Cancer Institute showed a slight decrease in incidence and mortality rates for males, but a slow increase in incidence and mortality rates among females (NCI(f), 2008).

Lung cancer tends to emerge during adulthood as a result of risk accumulation. The Lung Cancer Alliance (2009) indicated that only a small number of individuals are diagnosed with lung cancer before they are 45 years old. The largest number of lung cancer diagnoses occurs among individuals 65 years old or older (Lung Cancer Alliance, 2009). The likelihood of developing lung cancer increases with length of time, number of cigarettes smoked and exposure to asbestos or second hand smoke. Family history of lung cancer represents an additional factor that can increase individuals' likelihood of developing this condition (Mayo Clinic, 2009). While some researchers suggest different susceptibility towards developing cancer for males compared to females, the American Cancer Society does not support these findings (ACS-Susceptibility to Lung Cancer, 2004).

Colon cancer is another type of cancer that has an overwhelming impact on individuals' mortality. It represents the third leading cause of estimated new cancer cases and cancer deaths for both gender groups after lung and prostate/breast cancer (ACS(a), 2008). The American Cancer Society and the National Cancer Institute estimated 148,810 new cases of colon cancer in 2008, of which 77,250

were among males and 71,560 were among females. In addition to new diagnoses, 49,960 individuals were expected to die from colon cancer. Of the 1,095,283 individuals who had been diagnosed with colon cancer at some point in their lifetime, 48.6 percent were males and 51.5 percent were females (ACS(a), 2008). Just as with lung cancer, African American males were the most likely group to be diagnosed and die from colon cancer. Since 1998, colon cancer rates showed a slight decrease in both incidence and mortality rates.

Similar to lung cancer, colon cancer develops at later stages of life as a result of risk accumulation. An individual's chances of developing colon cancer increase with age with more than 90 percent of cases being diagnosed in individuals aged 50 or older (USDHHS, 2005). Family history of colon cancer and physical inactivity are risk factors that can greatly increase the chances of developing colon cancer (ACS(a), 2008). Reports indicate that the level of physical activity has recently increased among the general U.S. population (Blanck et al., 2008; NCHS, 2008; MMWR(b), 2007; MMWR(e), 2007).

Skin cancer represents the most common form of cancer in the United States with over one million diagnoses yearly (NCI: Common Cancer Types, 2008). There are two general types, melanoma and non-melanoma. Non-melanoma is the less precarious type of skin cancer while melanoma is a more dangerous form (NCI(h), 2008). Melanoma can be treated if diagnosed early (ACS(a), 2008). If not, cancer cells may attack other tissues, spread to other organs and become deadly (NCI(h), 2008). This study will only focus on melanoma of the skin.

Melanoma is the sixth and seventh leading cause of new cancer cases among males and females respectively (ACS(a), 2008). In 2007, melanoma was projected to account for about 59,940 (6 percent) of new skin cancer cases and 8,110 of skin cancer deaths (out of the 10,850 melanoma and non-melanoma deaths). In 2008, the American Cancer Society projected 62,480 new cases of melanoma. Of those, 55.9 and 44.1 percent of new cases were expected to be among males and females respectively (ACS(a), 2008). While incidence rates of melanoma have increased over time, mortality rates have remained low (ACS(a), 2008).

Major risk factors include family history of skin cancer, excessive exposure to sun, frequent sun-burning and increased use of indoor or outdoor tanning booths (ACS(a), 2008; ACS: Skin Cancer Facts, 2007). Despite increased preventability and low deaths rates from melanoma, conditions such as premature aging, cataracts and immune system disorders represent additional concerns associated with excessive sun exposure and lack of involvement in sun-safe practices (U.S. Environmental Protection

Agency, 2008). To avoid melanoma, individuals can adopt several protective behaviors one of which is regular sunscreen applications (CDC, 2008). Together, these types of cancers contribute to ranking this condition as the second highest cause of death in the U.S. (ACS (a), 2008).

## Biological Sex Considerations

Biological differences between males and females represent concerns when studying gender disparities related to cancer incidence, prevalence and deaths. While this study will not explore biological differences related to cancer development and mortality, it is important to acknowledge whether or not such differences account for variation in incidence or death rates.

A handful of studies have reported relationships between biological sex and cancer. Pater, a thoracic oncologist at the Northwestern Memorial Hospital in Chicago, indicated that women were more likely to have genes that made them more susceptible to damage from carcinogens (The Society of Women's Health Research, 2008;). Other investigators have also shown that lung cancer was more common in female never smokers than male never smokers (Storer, 2008; Belani, Marts, Schiller & Scinski, 2007). However, the National Cancer Institute has not supported these findings suggesting that risk for lung cancer is not due to biological differences between males and females (cited in Storer, 2008).

Studies exploring biological sex differences in terms of development and survival of colon cancer depicted a similar profile. Genes might account for different survival rates for males with colon cancer compared to females with the same type of cancer (Slaterry, 2004). Researchers concluded that biological sex differences might explain lower rates of colon cancer and higher effectiveness of response to treatment among women compared to men (Slaterry, 2004). Nevertheless, they also suggested more studies were needed to establish a base for biological sex differences.

The Ohio State Medical Center published a report indicating some biological sex differences with regards to skin cancer (Thomas-Ahner et al., 2007). The results of a controlled laboratory experiment (on mice) indicated that males, compared to females, were more susceptible to develop skin cancer and to have tumors. This could suggest that males might have a disproportionate risk of developing cancer due to biological sex differences regardless of their other risk factors. The researchers at the Center concluded that while there might be some basis for a biological bias, other studies needed to be conducted to confirm the findings. As of yet, there was no substantive and common agreement about an independent effect of biological sex on lung, colon or skin cancer development.

## Negative Affect (Worry) and Risk Perceptions

Studies have reported associations between feelings of worry and anxiety and risk perceptions. Hay, Coups & Ford (2006) reported that high levels of comparative risk as well as absolute risk were found among individuals who had more frequent feelings of anxiety and fear about colon cancer. Concurrently, Robb, Miles and Wardle (2004) found that 21.5 percent of participants with low anxiety levels perceived their risk for colon cancer as lower compared to 13.8 percent of people who had high anxiety levels and low risk perceptions. Other research has found consistent results with regards to a positive association between colon cancer worry and risk perceptions (Zajac, Klein & McCaul, 2006; Stark, Bertone-Johnson, Costanza & Stoddard, 2006; Weinstein et al., 2004; Lipkus et al., 2000; Lowestein et al., 2001). The relationship between lung or skin cancer worry and risk perceptions is not highly depicted in the current literature.

More importantly are the effects of risk perception and worry on health behaviors. Individuals' understanding of risk and their affective reactions influence the measures undertaken to reduce, eliminate or avoid health threats (Moser et al., 2007, Hay, Buckley & Ostroff, 2005, Sweet, Willis, Ashida & Westman, 2003). In addition, the relationship between risk and worry and health outcomes are dependent upon additional factors such as individuals' demographic characteristics, their health or cancer knowledge and/or previous experience or encounter with cancer (McQueen, Vernon, Meissner & Rakowski, 2008; Hay et al., 2007; Stanton, Janda, Baade & Anderson, 2004; Vernon, Myers, Tilley & Li, 2001). The following paragraphs highlight the characteristics and predictive influence of risk perceptions and worry as well as their determinants. In the following sections, worry and negative affect will be used interchangeably.

### Negative Affect (Worry)

One of the recent lines of research regarding negative affect explores whether or not worry, fear and anxiety are identical emotions. The researchers have not commonly agreed on the issue. Some researchers argue that worry, anxiety and fear are part of the same underlying concept and trigger comparable responses. Other researchers claim that the three emotions have distinct characteristics and can generate different responses.

The research that supports different response outcomes for worry compared to anxiety indicates that worry appears to be associated with adaptive and problem solving coping styles while anxiety is

associated with avoidance styles or excessive protective strategies (Zebb & Beck 1998; Borkovec, Ray, Stober, 1998). In the case of breast cancer, Brain, Norman, Gray and Mansel (1999) found that worry yielded non-pathological responses compared to anxiety which triggered hyper-vigilance and excessive breast self-examinations. Hirai et al. (2008) found that patients with high cancer-related worries were not necessarily in a severe anxious state. Other studies found a similar differentiation between cancer worry and anxiety (Sutton, 1998). Anxiety can be thought of as a level of worry that is much more frequent and disruptive.

Worry and fear are much more similar than worry and anxiety with a slight difference in the immediacy of the response. Worry does not require the adoption of immediate actions. However, both worry and fear require the presence of a specific threat (Bay & Algase., 1999). Lastly, Lief (1967) indicated that anxiety is chronic and focuses on general, non-immediate threat, whereas fear is acute and has a clearly defined motivation. Summarizing, worry is neither acute nor chronic, generally yields adaptive coping strategies, focuses on a specific danger and does not require immediate action. Fear is acute, generally yields adaptive behaviors, and requires a specific threat and immediate action. Both fear and worry, when extreme, can potentially generate non-adaptive behaviors. Anxiety is chronic, generally yields non-adaptive behaviors, is neither specific nor requires immediate actions.

In contrast, McKay (2005) reported that clinical and subclinical levels of anxiety or anxiety-related affect (which they referred to as worries) were associated with the same responses: attention bias towards threat-relevant information and disruptive thoughts. Hay, Buckley and Ostroff, (2005) suggested that worry represents a general emotion that could manifest itself through two states: fear and anxiety. Depending on which of these two is dominant, worry could generate both pathological and non-pathological responses. If anxiety is dominant, responses would portray a more pessimistic approach towards overcoming the threat, whereas if fear is dominant, a healthy emotional activity would emerge which would increase awareness and yield positive coping activities. Other researchers, such as Consedine et al. (2004), indicated that there is "the construct variously called worry, fear or anxiety" that influences breast cancer screening.

Research is controversial not only with regards to the differences between worry, fear and anxiety but also with regards to the concept of worry itself. Some researchers have argued that worry is emotional in nature while others have suggested that worry has both cognitive and emotional components. Clinical research emphasizes that worry has a cognitive and an emotional component

whereas health prevention and control literature argues that worry is based solely on emotional activity (Hay, Buckley & Ostroff, 2005).

The latter definition is supported by the dual-process theories related to information processing which suggests that worry is emotional in nature. According to this approach, worry and risk perception are part of the same whole where worry represents the emotional component and risk perception emphasizes the cognitive component (Lowenstein et al., Hay, Buckley & Ostroff, 2005; Slovic, Finucane, Peters & MacGregor, 2005). Turner and Stets (2005) similarly suggested that emotions and rationality were elements of the same whole. They further indicated that rationality and decision making were dependent on emotions. Without emotions, people would be unable to attach values to alternatives and would limit their health care options.

This report will follow the dual processing approach literature, since the main recommendations of the study are geared towards the prevention and control literature. Based on this approach, worry represents the emotional aspect of processing and risk perception characterizes the cognitive component of processing. In addition, while this study recognizes potential differences between worry, fear and anxiety, it is important to point out that the questionnaire did not use a multi-item scale that could capture the essential characteristics of worry versus fear and anxiety. Only one question was used to inquire about respondents' worries of future development of lung, colon or skin cancer. Even though respondents might have thought specifically of their feelings of worry when responding to this question, they could have thought about their fear of experiencing cancer or their anxiety related to cancer development as well. Thus, in this study there are no clear distinctions between worry, fear and anxiety.

**Risk Perceptions: Optimistic Bias**

After addressing the intricate nature of affect, this study highlights the complex structure of risk perceptions, namely optimistic bias. Optimistic bias represents a strategy used by individuals involved in unhealthy behaviors to justify their practice (Sloan, Smith & Taylor, 2003). Researchers have found that people engage in optimistic bias as a means to overcome the fear or anxiety associated with voicing personal vulnerability to disease (Weinstein et al., 2004). This bias influences individuals' perceptions of their likelihood of experiencing negative health events.

Optimistic bias has largely been studied in relation to smoking behavior. Researchers argue that smokers engage in optimistic bias and underestimate their likelihood of experiencing lung cancer or other smoking related illnesses. Smoking cessation represents a complex and burdensome strategy and it

influences individuals at the psychological, social and physiological level. Due to its difficulty, smokers use optimistic bias to lower both the negative feelings associated with maintaining smoking behaviors and the positive rewards resulted from quitting the habit (Klein, 2008; Waltenbaugh & Zagummy, 2004; Baker Dye, Denniston & Ainsworth, 2001; Arnett, 2000; Strecher, Kreuter & Kobrin, 1995).

In relation to skin cancer development, individuals engage in a different type of optimistic bias. These individuals underestimate their risk of developing skin cancer because the disease is highly preventable and is not perceived as hazardous (Branstrom, Kristjansson & Ullen, 2005). Weinstein (1987) compared individuals' risk perception for 32 health problems. The researcher found that optimistic bias was the strongest for health problems that were considered preventable, unknown, unusual or embarrassing. Low mortality and high curability rates of skin cancer have determined individuals to misjudge its effect on health. Branstrom, Kristjansson and Ullen (2005) found that respondents in their study had accurate knowledge about the link between sun exposure and development of skin cancer. Nevertheless, these participants underestimated skin cancer incidence and the impact of skin cancer on health.

**Cancer-Related Behaviors**

Communication researchers have examined the relationships between risk perception and health behavior and concluded that perceived vulnerability to a threat is the main motivating factor that determines the adoption of precautionary behaviors (Weinstein, 1993). Many empirical studies have reported that perceived risk was positively associated with adoption of preventive behaviors among adults (Hay et al., 2007, Berkowitz et al., 2007, Branstrom, Kristjansson & Ullen, 2005).

Hay et al. (2007) examined the relationship between lung cancer risk perceptions and smoking among newly diagnosed cancer patients. They found no association between initial risk perception and smoking at three-month follow up, but they reported significant results between three-months and 12-months follow-up. The higher the individuals' risk perceptions at three-month the more likely they were to report being abstinent at 12-months. Thus, risk perception at three-month follow up predicted smoking status at 12-months. In addition, researchers found that those who received a new cancer diagnosis between three and 12-months had higher risk perceptions compared to those who did not. Finally, patients who relapsed had the highest risk perceptions. This study indicated that people who had initial high risk perceptions abstained from smoking at follow-up and at the same time those who restarted smoking also developed high risk perceptions.

Robb, Miles and Wardle (2004) indicated that approximately 13 percent of smokers perceived their comparative risk to be lower compared to 18 percent of non-smokers who reported lower comparative risks for developing smoking related illnesses. Other studies concurred with the findings that smokers had higher risk perceptions of developing health conditions as a result of smoking compared to non-smokers (Weinstein, 1999, Segerstrom et al., 2004; Weinstein, Marcus & Moser, 2005) or that non-smokers perceived themselves at lower risk compared to smokers (Ayanian & Cleary, 1999). Nevertheless, there are other pieces of research that indicate the opposite (Waltenbaugh & Zagummy, 2004; Baker, Dye, Denniston & Ainsworth, 2001; Arnett, 2000). Highlighted in the section about optimistic bias, these reports suggest that smokers engage in optimistic bias and perceive themselves at lower risk of developing smoking related illnesses compared to their healthier counterparts.

Weinstein et al. (2004) found that among patients who did not personally experience cancer, relative risk perception about colon cancer increased with family history of cancer and decreased with physical activity. Robb, Miles and Wardle (2004) reported that sedentary individuals indicated increased colorectal cancer risk. Approximately 12 percent of sedentary individuals thought they had lower comparative risk for colorectal cancer versus 19 percent of those who reported regular physical activity and thought they were at lower comparative risk for that type of cancer.

Bowen, Alfano, McGregor and Andersen (2004) found no association between risk perceptions and the level of physical activity adopted. The discrepancy between Weinstein et al. (2004) and Robb, Miles and Wardle (2004) versus Bowen, Alfano, McGregor and Andersen (2004) can be attributed to the type of cancer studied. The first two studies examined colon cancer risk perceptions while the last study examined breast cancer risk perceptions. It is possible that people are more knowledgeable about the association between physical activity and risk reduction for colon cancer compared to breast cancer.

Stanton, Janda, Baade and Anderson (2004) reported a positive association between risk perception of skin cancer and adherence to sun-safe practices. Individuals who perceived themselves at higher risk indicated regular use of sunscreen and regular medical check-ups. Similarly, Christensen et al. (2007) reported that adoption and maintenance of sun protective behaviors increased with perceived risk before and after a preventive program was implemented.

Several studies examined feelings of worry as potential influencers of adoption of healthy behaviors. These reports yielded mixed results. Some concluded that feelings of worry increased motivation or intention to engage in healthy behaviors (McQueen, Vernon, Meissner & Rakowski, 2008; Mullens, McCaul, Erickson & Sandgren, 2004). Others indicated that excessive feelings of worry were

associated with avoidance mechanisms. These studies suggested that people reporting higher negative affect were less likely to adopt healthy practices (Hay, Buckley & Ostroff, 2005). Overall, research indicates a slight bias towards a positive relationship between worry and adherence to health behaviors.

Most of the studies that explored the relationship between affect and health behavior have, generally, focused on adherence to screening methods for breast, prostate and colon cancer. Colon cancer studies suggested that increased feelings of worry were associated with having regular screening tests and intentions to make positive health behavioral changes (Berkowitz et al., 2008; Moser et al., 2007; Mullens, McCaul, Erickson & Sandgren, 2004). Berkowitz et al., (2008) found that individuals who worried about finding colon cancer were up to date with colon cancer screenings compared to individuals who did not worry.

Concurrently, Moser et al., (2007) found that increased feelings of worry about colon cancer were associated with undergoing colonoscopy or sigmoidoscopy. Individuals who reported increased feelings of worry were 1.32 and 1.42 times more likely to have had a sigmoidoscopy and colonoscopy respectively. Mullens, McCaul, Erickson and Sandgren (2004) suggested that individuals who worried were more likely to report intentions to change their behaviors towards healthier lifestyles (i.e. diet, exercise, weight loss, smoking, complementary therapy) compared to those who did not worry.

Concluding, findings are mixed. There is no consistent pattern for the relationship between risk perception and worry and involvement in health behaviors. Some studies highlighted that higher lung cancer risk perceptions had a positive impact on smoking cessation and that smoking or smoking relapse yielded increased risk perceptions. In contrast, investigators also suggested the possibility of optimistic bias among smokers. The relationships between skin cancer risk perception and behavior generated a similar pattern. Sometimes, skin cancer risk perceptions yielded higher involvement in sun-safe practices. However, Clarke, Williams and Arthey (1997) highlighted that individuals, commonly, engage in tanning and sun protective practices at the same time, a situation that can increase people's perceived risk or worry despite adherence to regular sun-safe behaviors. Studies have also reported optimistic bias with regards to skin cancer development due to disease curability levels. Findings related to colon cancer risk perceptions suggested a positive relationship between risk perception and involvement in unhealthy practices. People who did not engage in physical activity reported increased risk perceptions.

The current research was not very clear about the direction of the relationship between worry and health behaviors. In most studies, worry promoted adherence to healthy behaviors nevertheless, there were studies which suggested that worry inhibited involvement in those practices.

**Cross-Sectional Data, Risk Perceptions, Worry and Behaviors**

In an extensive review of literature, Hay, Buckley and Ostroff (2005) differentiated the results by study design. Weistein and Nicolich (1993) and Hay, Buckley and Ostroff (2005) found that among prospective studies, there was a strong indication for a positive relationship between cancer worry and screening behaviors. Nevertheless, they indicated that the majority of studies which explored this relationship were cross-sectional (Hay, Buckley & Ostroff, 2005). Among those studies, findings were inconsistent. Some indicated that cancer worry facilitated future intentions and actual screening actions. Other studies suggested that cancer worry inhibited screening. Kline and Stefanek (2009) further explained that worry about cancer is positively associated with adoption of cancer screening while worry about screening is negatively associated with screening.

These authors studied the influence of risk perceptions as well. They suggested that depending on the design of the study and the survey instrument, the relationship between risk perceptions and behaviors generally examines two important issues, (1) the relative accuracy of the risk perception in association with risk-influencing behaviors and (2) risk perception as a cause for adoption of self-protective behaviors (Weinstein & Nicolich, 1993). Basically, these issues ask (1) if people's perceptions about their personal risk of developing cancer correctly reflect the extent to which they are involved in cancer-related behaviors, and (2) if people's perceptions of their personal risk motivate them to engage in self-protective behaviors to reduce that risk. Weinstein, Rothman and Nicolich (1998) suggested that in cross-sectional research, the relationship between risk perception and behavior is referring to the first question and is portraying the "relative accuracy of risk perception" in relation to the behavior. Concurrently, Page, Cole and Timmerck (1995) indicate that cross sectional studies cannot identify risk or future likelihood of occurrence from a given characteristic; they cannot predict an upcoming health event happening since both measures are assessed simultaneously and thus risk perceptions are affected by behaviors. Consequently, the relationships between risk perceptions and behaviors for prospective studies versus cross-sectional data yield different results.

In prospective designs, researchers should expect a positive relationship between risk perceptions and protective behaviors and a negative one with unhealthy habits. In cross-sectional data, these relationships are reversed. Researchers who are interested in examining the relative accuracy of risk perceptions should look for a negative relationship between risk perceptions and protective behaviors and a positive one with unhealthy habits (Weinstein & Nicolich, 1993). Since this study employs a cross-

sectional design, it examines the relative accuracy of risk perceptions rather than the causal effect of risk perceptions on behaviors. Thus, a high degree of "relative accuracy" indicates a strong negative correlation between the perceived risk and the number of preventive behaviors a person is performing.

**Demographic Factors and History of Cancer**

Gender differences have been noted in relation to risk perceptions and worry. Generally, females' role as the care giver of the family has led them to overestimate their risks and to worry more about developing health issues (Honda & Neugut, 2004, Oncken et al. 2005, Robb, Miles & Wardle, 2004). Robb, Miles and Wardle (2004) reported that males, compared to their counterparts, held lower perceptions of risk for colorectal cancer. More recently, McQueen, Vernon, Meissner & Rakowski, (2008) indicated that, across several types of cancers, males reported higher comparative risk perceptions compared to females. The emergence of cancer prevention campaigns to prevent prostate and testicular cancer could have increased awareness level about cancer in general, among males. In turn, the higher awareness might have contributed to increased risk perceptions, making males more similar to females.

In terms of worry, males who adhered to healthy lifestyle reported lower levels of worry versus females with comparative lifestyles (McQueen, Vernon, Meissner & Rakowski, 2008). Other studies noted that women were more likely to worry that sun exposure could cause premature aging and skin cancer compared to men (Branstrom, Kristjansson & Ullen, 2005, Miles, Waller, Hiom & Swanston, 2005). These women also reported more readiness to change their sunbathing behavior compared to their counterparts (Branstrom, Kristjansson & Ullen, 2005, Miles, Waller, Hiom & Swanston, 2005). Based on this research it seems that females, compared to males with similar lifestyle habits, reported increased feelings of worry.

Family history of cancer yielded increased feelings of worry and more inflated risk perceptions about developing cancer. Vernon, Myers, Tilley and Li (2001) examined risk perception of colorectal cancer among males comparing those with versus those without cancer histories. Family history of colon cancer was associated with increased risk perception of colon cancer. Other studies indicated higher colon cancer perceived risk score for individuals who had a personal history of colon polyps, family history of colon cancer or personal history of other cancers compared to those who did not have any of these situations (Stark, Bertone-Johnson, Costanza & Stoddard, 2006; Alberto, Harocopos, Patel & Clark, 2006; Montgomery, Erblich, DiLorenzo & Bovnjerga, 2003). When both gender groups were included, DiLorenzo et al. (2006) found that family history of colon cancer predicted higher risk

perception but also increased levels of worry among both males and females with a stronger effect for females.

Age plays an important role in determining risk perceptions and levels of worry as well. Existing literature indicates that younger individuals hold more inflated risk perceptions about developing colorectal cancer (McQueen, Vernon, Meissner & Rakowski, 2008; Clipp et al., 2004; Mullens, McCaul, Erickson & Sandgren, 2004). Robb, Miles and Wardle (2004) reported that approximately 18 percent of individuals of ages 60 to 64 compared to 16 percent of participants with ages between 55 and 60 indicated lower risk perceptions. Similarly, Stark, Bertone-Johnson, Costanza and Stoddard, (2006) found that participants between ages 50 and 64 reported higher risk perception score compared to individuals with ages between 65 and 75. Loesher (2003) found that individuals 41 to 50 years old had higher levels of worry compared to their older and younger counterparts. Other studies supported a negative relationship between worry and age (Bjorvatn et al., 2007; Hay, Buckley & Ostroff, 2005; Mullens et al., 2004).

It appears that individuals who are about 50 years old develop more inflated risk perceptions and higher levels of worry about colon cancer. This pattern could suggest that approaching the age where the risk of developing colon cancer increases (50 years old) generates higher risk perceptions. However, after a certain period of not developing cancer the high risk perceptions might be diminished due to the absence of colon cancer. Hay, Coups and Ford (2006) made similar suggestions.

The relationships between age and risk perceptions for lung cancer studies were similar to the ones of colon cancer. Both Dillard, McCaul and Klein (2006) and Oncken et al. (2005) reported that older individuals held lower risk perceptions with regards to their likelihood of developing lung cancer. Moreover, Viscusi (1991) suggested that risk perceptions were more inflated among younger age groups, where overall lung cancer risks were considerably overestimated.

Family history of cancer seemed to be the strongest predictor of higher risk perceptions among all cancer types. Overall, it seemed that having a history of cancer, being younger and not adhering to healthy behavioral recommendations were associated with increased risk perceptions for developing cancer. Being a female has historically been related to higher risk perceptions; nevertheless recent findings indicate a reversed relationship. The results related to demographic characteristics and feelings of worry were fairly straightforward suggesting that increased feelings of worry were associated with being a woman, being younger and having a family history of cancer.

## Health Information Seeking Behavior

During the last decade, consumers' health information seeking behavior has changed due to a general rising concern for health issues as well as a growing number of readily available sources of health information (Case, 2002). More access to the Internet, and the proliferation of online health information websites have been partly responsible for the change in health information seeking behavior. The World Wide Web has made health information seeking easier and more accessible in today's society. Health consumers can retrieve information from home, at any time and from a multitude of sources.

As a result, health information over the Internet has become an important tool for health consumers and health promoters. On one hand, it allows health communicators to widely disseminate information and on the other it empowers and motivates health consumer to pursue disease-free lifestyles (Krop, 2006). It also prepares individuals cognitively, emotionally and practically to deal, manage or overcome health threats. Online health information seeking as well as knowledge gain increases perceived control over one's health-related management skills as well as improve their adherence to health practices.

Researchers have reported that individuals with higher levels of anxiety tend to pay more attention to information that relates to their illness-anxiety in an attempt to reduce their negative affect (Owens, Asmundson, Hadjistavropoulous & Owens, 2004). Moreover, Klein and Stefanek (2009) suggested that people who feel more at risk tend to spend more time seeking for health information that might be used to understand and reduce risk.

Nonetheless, there are some caveats related to online health information seeking. The sources of information represent a problem as they are not always reliable or consistent (Cline & Haynes, 2001). The large amounts of information/sources, their ambiguity as well as the discrepancies between them can work in the opposite direction and increase anxiety and risk perceptions among seekers. Han, Moser and Klein (2006) indicated that people who perceived inconsistencies or ambiguity in available messages about cancer risk reduction reported increased risk perceptions and viewed cancer as less preventable. Lambert and Loiselle (2007) similarly noted that seekers, who found the information they wanted, reported reduced worry compared to those seekers who did not encounter the needed health information. While the analyses of this study do not discuss or account for the barriers to online health information seeking, it is important to acknowledge external factors that could affect the relationships between online health information seeking and its predicted outcomes.

Finally, the issue of the digital divide and the knowledge gap between higher and lower groups of society should be considered when addressing online health information seeking. Since Internet access is not universal in the U.S., computer availability, educational level and individual's computer skills represent elements that affect the extent of online health information seeking and the knowledge gain (Cline & Haynes, 2001; Krop, 2006). The sections below describe the current state of health information seeking over the Internet in the U.S.

Nielsen Online reported that approximately 220 million Americans (or roughly 80 percent) had access to the Internet at home and/or work in 2008 (Nielsen Online, 2008). Approximately eight in 10 Internet users reported having searched for health information online (Pew Research & American Life Project, 2006). This represented an increase from earlier studies which indicated that a lower percentage of adult internet users sought health information online. Brodie et al. (2000) reported that 31 percent of all respondents and 55 percent of Internet users 60 years old or below used their computers to get health information. Baker, Wagner, Singer and Bundorf (2003) reported that 40 percent of their sample accessed the Internet to look for health information. To that end, Cline and Haynes (2001) indicated that internet users generally engaged in three primary health information seeking activities over the Internet: searching directly for health-related information for themselves or others, communicating to health care providers and participating in support groups.

Arora et al. (2008) reported that approximately 44.9 percent of Americans sought cancer information specifically. The Internet was the most prevalent medium for cancer information seeking. Fogel et al. (2002) noted that 41.4 percent of breast cancer patients used the web for information about their condition. A later study, employing patients from a lung cancer clinic, indicated that Internet was the third most common source of retrieving information about this condition (Peterson & Fretz, 2003). This medium ranked behind information sources such as physicians and subspecialists and ahead of sources such as family, friends, medical journals, television and magazines. Recent research suggests a general involvement in online health information seeking.

**Cancer-Related Behaviors**

Health information seeking behavior represents a key factor in the relationship between perceived threats of disease and the likelihood of taking action (Lambert & Loiselle, 2007). There are several important consequences of health information seeking including information gain, attitude change, behavioral change or maintenance and increased perceived self-control over managing the health

threat (Johnson, 1997). Individuals who are active health information seekers are more likely to confront the health problem, engage in preventive behaviors and seek prompt treatment (Johnson, 1997). Information seekers tend to be more knowledgeable as well (Case 2002, Johnson, 1997).

After conducting an extensive analysis of the determinants and characteristics of health information seeking behavior, Lambert and Loiselle (2007) concluded that generally, health information seeking is related to individuals' knowledge and decision to engage in preventive behaviors. They emphasized that while information seeking behavior might not be directly related to the adoption of healthy behaviors, it increases individuals' knowledge and it motivates them to consider making changes towards a healthier lifestyle. Dutta-Bergman (2005) reported that individuals who engaged in healthy behaviors were more likely to be health information seekers compared to those who reported fewer health practices. Additionally, studies suggested that smokers who sought health information on quitting strategies had a higher likelihood of succeeding in their attempts (Zhu et al., 2000, Editorial 2000).

Shim, Kelly and Hornik (2006) examined differences in breast, prostate and colon cancer screening behaviors based on seeking and scanning health information. Seeking was characterized by more central processing of information while scanning was defined by access to large amounts of health information but less attention to detail. The researchers found that scanning and seeking were significantly associated with increased knowledge about cancer and adherence to cancer screening.

Individuals who engaged in scanning and seeking were 1.38 and 1.44 times more likely to participate in colonoscopy. Similarly, men who sought and scanned cancer information were 4.53 and 10.01 times more likely to engage in prostate screening behaviors. Only, scanning was significantly associated with recent mammography (odds ratio = 1.46). The study concluded that individuals who looked for health information were more likely to acquire knowledge and get screened for cancer. While this study will not differentiate between scanning and seeking, it is important to highlight that regardless of the cognitive depth of the health information seeking behavior, people who are active about looking for health information tend to acquire increased health knowledge and to report intention to engage in screening practices.

An extensive report prepared by the Pew Research and the American Life Project (2006) indicated that 58 percent of Internet health seekers reported that their most recent health information search influenced a decision about how to treat an illness. Roughly 55 percent said health information seeking changed their overall approach to maintaining their health and 44 percent said the information changed the way they thought about diet, exercise, or stress. Moreover, 35 percent indicated that the

information affected a decision about whether to see a doctor (Pew Research & American Life Project, 2006). Other studies have found concurrent results (Tu and Cohen, 2008; Baker, Wagner, Singer and Bundorf, 2003).

Comparing online health information seekers and non-seekers, Dutta-Bergman (2004) found a significant mean difference with regards to individuals' involvement in healthy activities. Internet users who sought health information were more health aware and had stronger health-related beliefs. In addition, Internet users who sought information specific to healthy lifestyles, compared to their counterparts, were also more likely to be involved in healthy (mean score of 4.71 versus 3.75). Shim (2008) indicated that looking for cancer specific information was positively related with cancer knowledge. Overall, findings suggested that health information seeking behaviors generates more knowledge and could potentially lead to implementation of positive health practices such as regular screening, dieting, exercising or smoking cessation.

**Demographic Factors and History of Cancer**

Health information seeking behaviors are influenced by numerous individual factors such as age, gender, education and personal experience with cancer (Case, 2002). Johnson (1997) explained that a personal experience with cancer is very relevant in predicting cancer health information seeking behavior as it raises consciousness about the condition. In addition, women, higher educated and younger individuals tend to seek health information more often compared to their respective counterparts (Ramanadhan and Viswanath, 2006). Internet health information seeking highlights similar demographic characteristics. The research, which defined the "digital divide" as the inequality between socio-demographic factors and health information seeking over the Internet, indicated that individuals with lower income, lower educational level and of ethnic minority have less access to the Internet and have less opportunities to seek health information online compared to their counterparts (Brodie et al., 2000). While the divide is still present, the trends show a slight increase in Internet use among the poor (Parks Associates, 2008).

The Pew Research and the American Life Project (2006) indicated that compared to males, females engaged in more health information seeking over the Internet. Approximately 82 percent of females compared to 77 percent of males looked on the World Wide Web for health information. Tu and Cohen (2008) found that males, compared to females, were 50 percent less likely to use the Internet for health matters. Additional studies noted higher involvement in online health information seeking among

females compared to their counterparts (Shim, 2008; Lorence, Park & Fax, 2006; Baker, Wagner, Singer & Bundorf, 2003).

Several factors can explain the difference between males and females and their health information seeking. Many women help manage their partners' and children's health needs, and over one in 10 women are responsible for taking care of an aging or chronically sick relative or parent (Salganicoff, Ranji & Wyn, 2005). More than half of women are responsible to select a doctor for their child (79 percent), to take the child to doctor (84 percent), to ensure the child gets recommended care (78 percent), and to make health insurance decisions related to the child (57 percent). Moreover, 26 percent of women with children are single parents and thus responsible for all health decisions. Providing medical care represented the forth most common household activity undertaken by women. Women's large amount of health-related responsibilities has led them to become more avid health information seekers and more knowledgeable.

Age-wise, the largest group to seek health information over the Internet seems to be the baby boomers (HON, 1999a in Cline and Haynes 2001). Individuals, who are 40 years of age or older, represent 60 percent of the online health consumers, whereas individuals, who are 60 years old or older, comprise eight percent of the seekers. Tu and Cohen (2008) reported no significant differences in terms of online health information seeking for individuals with ages between 18 and 34 and 35 to 49. There were statistically significant differences between individuals with ages between 18 to 34 years old and individuals 50 years old and over, with the latter group engaging in less online health information seeking. Other reports have found concurring results (Lorence, Park & Fox, 2006; Baker, Wagner, Singer and Bundorf, 2003)

Ethnically, non-Hispanic Whites spent more time online compared to other racial groups (Miller, West & Wasserman, 2007). The 2007 Health Tracking Household Survey, which employed a nationally representative sample, similarly indicated that non-Hispanic Whites sought the most health information online followed by African Americans and Hispanics (Tu & Cohen, 2008). Shim (2008) concluded that African Americans and Hispanics sought less cancer-specific information online than non-Hispanic Whites.

Health information seeking over the Internet increased with years of education. Individuals with a college degree reported the highest percentage of online health information seeking, 89 percent; compared to 71 and 80 percent of individuals with high school or less or some college education

respectively (Pew Research & American Life Project, 2006). Shim (2008), Baker, Wagner, Singer and Bundorf (2003) and Brodie et al. (2000) found similar results.

Johnson (1997) indicated that education was one of the strongest predictors of health information seeking compared to other socioeconomic measures. He acknowledged that this was partly because education provided a base for deciding what information was needed; it provided a set of criteria for evaluating the nature of the information; and it provided the foundation for effective search strategies (Johnson, 1997).

Lastly, the Pew Research report suggested that Internet users living with a chronic disease were more likely than other internet users to look for health information (Pew Research & American Life Project, 2006). Other studies that focused on the relationship between online health information seeking and health status yielded similar results. Lorence, Park and Fox (2006) acknowledged that 82 percent of interviewees with a health condition reported seeking information online versus 64.6 percent of those who did not indicate a health condition. Tu and Cohen (2008) found that individuals with one or more health conditions were also more likely to seek health information over the Internet compared to their healthier counterparts.

The studies presented in this section suggested that being a female, being non-Hispanic White, having higher education, being younger and having a health condition were all determinants of higher level of online health information seeking.

## Cancer Knowledge

Knowledge just like health information seeking behavior can positively impact health outcomes by increasing awareness of risk factors as well as adoption of preventive practices (Johnson, 1997; Case, 2002). Previous research on cancer has linked knowledge of risk factors with adoption of positive lifestyle factors such as smoking cessation and sun-safe behaviors (AICR 2007, Halpern & Kopp, 2005). Health behavioral theorists suggest that individuals' understanding of the link between a health behavior and its ability to achieve a desirable health outcome is an important determinant of whether that individual will practice that behavior (Azjen, 1991, Becker 1974, Prochaska & DiClemente, 1983).

The National Cancer Institute suggested that most people know that cancer is preventable (NCI Brief 2, 2007). Approximately 64.0 percent of respondents indicated that lifestyle and behavioral habits affected cancer risk. Smoking cessation was the most cited cancer preventive strategy. Roughly 40.8 percent reported that quitting smoking contributed to reduced risk factors. Similarly, 25.3 percent

indicated eating healthy, four and a half percent reported getting regular check-ups, three and a half percent noted regular exercising and two percent suggested sun-safe practices as strategies to reduce cancer risk. Approximately 15.5 percent or 32 million people still thought there was nothing they could do to prevent cancer development (NCI Brief 2, 2007). It seems that people generally know that cancer is preventable and that smoking cessation represents a cancer reducing strategy. However, they are not very familiar with other cancer-protective strategies and some even report cancer as an unpreventable disease.

**Cancer-Related Behaviors**

Hawkins, Berkowitz and Peipins (2007) found that knowledge of cancer-reducing strategies positively affected involvement in the promoted strategy. Participants who reported awareness about physical activity as a cancer prevention strategy also indicated higher levels of physical activity. This concurs with other studies that support the positive association between knowledge and involvement in health preventive behaviors (Cerully, Klein & McCaul, 2006; Robinson, Rigel & Amonette, 1997).

The relationship between knowledge of no-smoking/smoking cessation as a cancer preventive measure yielded similar results (Hawkins, Berkowitz & Peipins, 2007). Knowledgeable individuals reported intention to quit smoking. Current smokers who indicated no-smoking/smoking-cessation as a preventive measure against cancer indicated they were planning to quit smoking compared to those current smokers who did not mention no-smoking/smoking-cessation as cancer preventive strategy. In contrast, never smokers were less likely to mention no-smoking/smoking-cessation as a cancer prevention strategy compared to former smokers and current smokers (Hawkins, Berkowitz & Peipins, 2007). Former and current smokers while they were more knowledgeable about preventive strategies chose to disregard the information. This is consistent with previous literature on smoking which indicates knowledge of risk factors is not sufficient to stop this addictive habit.

Knowledge of skin cancer seemed to have increased in the population while adherence to sun-safe practices has declined or remained unchanged overtime (NCI(a), 2007). Robinson, Rigel and Amonette (1997) reported that knowledge of the harmful effects of sun exposure increased, but sunburning and regular use of tanning booths also increased. A more recent study noted the same increase in tanning behaviors (Robinson, Kim, Rosenbaum & Ortiz, 2008). Other studies have found similar results: individuals were knowledgeable about sun protective strategies and engaged in sun-safe practices; but they also exposed themselves to sun (Clarke, Williams & Arthey, 1997).

**Demographic Factors and History of Cancer**

Females, individuals between 35 and 64 years old, higher educated respondents and those with cancer histories had higher knowledge of preventive behaviors compared to their counterparts (Hawkins, Berkowitz & Peipins, 2007). In contrast, Hispanics and individuals with lower levels of education were least knowledgeable about precautionary strategies.

Shim (2008) found similar results in relation to lifestyle, screening and overall knowledge. The researcher found a statistically significant positive relationship between age and education and knowledge. Individuals who were older and higher educated reported higher knowledge. In addition, higher knowledge level was associated with being a female, having a family history of cancer and being non-Hispanic White. Coups, Hay and Ford (2008) noted that gender was not significantly associated but education was positively associated with knowledge of the benefits of physical activity. Individuals with ages between 40 and 49 were more aware that exercising had a role in preventing colon cancer compared to their younger and older counterparts (Coups, Hay & Ford., 2008).

Both Coups, Hay and Ford (2008) and Hawkins, Berkowitz and Peipins (2007) employed nationally representative samples. The inconsistency between males and females' knowledge level can result from the difference in the number of cancer preventive practices asked by each study. Hawkins, Berkowitz and Peipins (2007) examined a variety of cancer preventive strategies while Coups, Hay and Ford (2008) only examined physical activity. When asked about physical activity as potential cancer reducing strategy, males might be more similar in their awareness level compared to females as they are more interested in physical activity. However, when asked about additional strategies, as in the case of Hawkins, Berkowitz and Peipins (2007), males' lower levels of health knowledge might surface and thus yield significant differences between them and the female group. With regards to age and knowledge of physical activity or other cancer preventive strategies, both studies indicated that middle-aged individuals were the most knowledgeable group.

Miller et al. (1996) reported similar findings but with regards to melanoma. Awareness of melanoma increased with education. The lowest level of knowledge was encountered among males and individuals with lower education. Being a female and older was associated with more skin cancer knowledge. Most participants (95%) in this study recognized at least one risk factor for melanoma. Of those, only 26 percent were able to correctly identify specific signs of melanoma.

A more recent study concurred with the previous findings and suggested that the percentage of people who were aware of preventive measures against skin cancer was fairly high (Miles, Waller, Hiom & Swanston, 2005). Approximately 65 percent of respondents knew that they should seek shade and 50 percent knew they needed to wear clothing that protected them against the harmful effects of the sun rays. Awareness of protective sun behaviors increased with years of education, age and being a female. Other research indicated the same positive relationship between age and awareness of sun-safe practices (Robinson, Rigel & Amonette, 1997). In addition, females were 1.8 times more likely to be knowledgeable about sun-safe practices compared to males. With each educational level, individuals in the higher category were 1.3 times more likely to know protective sun-practices (Robinson, Rigel & Amonette, 1997).

### Gender, Health Information Seeking, Knowledge, Risk Perception and Worry

Information seeking behavior and health knowledge acquisition impact one's lifestyle and health in several ways. Individuals who are more informed and knowledgeable are presumably more likely to adhere to healthy behaviors, to recognize disease risk factors and symptoms and to seek regular health care services (Hawkins, Berkowitz & Peipins, 2007; Lambert & Loiselle, 2007; Cerully, Klein & McCaul, 2006; Case, 2002; Johnson, 1997; Miller et al., 1997). In addition, studies have generally supported that information seeking and knowledge can reduce anxiety about developing bad health and yield accurate risk perceptions, conditioned that information is not vague or inconsistent.

In addition, the research so far has suggested that women, compared to men, seek health information more frequently, are more knowledgeable about health and cancer and engage in more frequent cancer-related preventive behaviors. Consequently, females compared to males should report fewer worries and more accurate risk perceptions. However, the findings have suggested the opposite. There are several explanations for these inconsistencies.

Leydon et al. (2000) has suggested that women tend to have a more fatalistic approach to health and upon receiving information they continue to worry while men decide to adopt the policy of "life as normal" where cancer can be forgotten. The researchers further suggested that females were also more likely to communicate their worries, compared to their male counterparts, potentially appearing as holding more frequent and more inflated feelings of worry. In addition, due to their numerous health-related responsibilities, females might just develop more worries (Salganicoff, Ranji & Wyn, 2005).

In terms of risk perception and knowledge, some studies found that, among females, higher knowledge generated higher risk perception. The "Race for the Cure" and the pink ribbon campaigns have been successful in raising awareness but also risk perceptions about breast cancer. Women, today, tend to largely overestimate their risk of developing breast cancer (Dearborn & McCullough, 2009). Similarly, Gurmakin et al. (2005) found that risk perception levels following genetic counseling for breast cancer were higher compared to pre-counseling. Therefore, it seems that an increase in awareness and knowledge level among women can lead to higher risk perceptions. Despite these differences between males and females, a recent study suggested that males and females might be becoming more similar in their risk perceptions (McQueen, Vernon, Meissner & Radowski, 2008).

## Cancer-Related Behaviors

Smoking, physical inactivity and excessive sun exposure represent risk behaviors that can increase one's chances of developing lung, colon and skin cancer respectively (Oncology Nursing Society, 2007, ACS(a), 2008). Researchers estimate that 50 to 75 percent of cancers can be prevented through some type behavioral change (NCI: Cancer Trends Progress Report-2007 Update, 2007). Smoking, for instance, accounts for 30 percent of all cancer deaths and 87 percent of lung cancer deaths, (ACS(a), 2008; NCI: Cancer Trends Progress Report-2007 Update, 2007, USDHHS(a), 1989). Physical inactivity is estimated to cause about 40 percent of some of the major cancers. Excessive sun exposure represents the leading preventable cause of skin cancer (ACS: Detailed Guide, Skin Cancer, 2008; Health-Alliance: Cancer Services, 2006).

### Smoking

In the U.S., tobacco use is responsible for one of five deaths (ACS: Cigarette Smoking, 2008). In addition, 8.6 million people are estimated to develop a smoking related illness as a result of tobacco use (MMWR(f), 2005, MMWR(g), 2003). Approximately 19.8 percent of adults, 22.3 percent of males and 17.4 percent of females, are current cigarette smokers (MMWR-Smoking, 2008). Comparing nationally representative adult samples from 1988-1994 and 1999-2002, O'Conner et al. (2006) found a decrease in nicotine intake related to cigarette smoking across all demographic groups. Nevertheless, the smoking rates have remained stable since 2004 (MMWR(c), 2007) and the gap between male and female smoking has remained unchanged (5%) since mid 80s (MMWR(c), 2007).

Current smoking rates vary by demographic groups. American Indian/Alaska Natives (36.4%) smoke more than non-Hispanic Whites (21.4%) and African Americans (19.8%), who in turn smoke more than Hispanics (13.3%) and Asians (9.6%) (MMWR-Smoking, 2008). Smoking rates are higher among individuals with just high school degrees and decline with education. Similarly, smoking is higher among younger adults and tends to decline with age (MMWR(c), 2007; MMWR-Smoking, 2008). Comparing cancer survivors versus non-cancer individuals, Mayer et al. (2007) found no significant differences between the two groups in terms of their smoking habits. Approximately 18.4 percent of those without cancer and 22.5 percent of survivors were current smokers. In addition, males and younger individuals (65 years old or under) indicated higher levels of smoking compared to females and older persons.

**Physical Activity**

Physical activity can reduce the risk for developing colon cancer by roughly 40 percent and can improve the quality of life for cancer patients and survivors (NCI(k) 2007). In 2007, 30.8 percent of U.S. adults engaged in regular leisure-time physical activity, which was not significantly different from the 2006 estimate of 30.9 percent (CDC – Leisure-time Physical Activity, 2008). In 2006, approximately 40 percent of individuals 18 years of age and over reported no physical activity (NCHS(c), 2008, NCHS(d), 2008, NCI(k), 2007). The percentage of people who engaged in physical activity increased with education and decreased with age among both males and females (MMWR(b), 2007). Non-Hispanic Whites were the most likely group to report regular physical activity (33.8%) followed by Hispanics (23.8%) and African-Americans (23.2%) (CDC-Leisure-time Physical Activity, 2008). Overall, women were less likely than men to engage in regular physical activity (32.9% of males and 28.9% of females).

The National Cancer Institute similarly suggested that women reported less involvement in regular physical activity, compared to men. However, women were more likely to look for information about exercise (NCI, Brief 4, 2008). Other reports have found similar results (MMWR(b), 2007). When examining individual age groups separately, women with ages between 25 to 64 years old did not differ from men in the same age groups in terms of their physical activity levels (CDC-Leisure-time Physical Activity, 2008; MMWR(b), 2007). Comparing cancer survivors versus non-cancer individuals, there were no significant differences in physical activity behavior between the two groups (Mayer et al., 2007). Approximately 53.0 percent of those without cancer and 45.3 percent of cancer survivors participated in regular physical activity. Despite shown benefits of physical activity on quality of life and

prevention of cancer, individuals, so far, have failed to reach the objectives of Healthy People 2010 (MMWR(b), 2007).

**Sunscreen Usage**

Lastly, sun-safe practices represent the main protective behaviors against developing skin cancer (ACS: Detailed Guide, Skin Cancer, 2008; Health-Alliance: Cancer Services, 2006). Current findings suggest that sun-safe practices declined from 1992 to 1998, increased between 1998 and 2000, remained stable between 2000 and 2003 and fell slightly between 2003 and 2005 (NCI(b), 2007). The same patterns emerged in males and females, except that lately (2003-2005) females' practices were stable while males' behaviors declined (NCI(b), 2007).

According to the National Cancer Institute, 28.3 percent of individuals used sunscreen always or often, being the third most frequent sun-safe practice behind seeking shade and wearing hats (NCI Brief 6, 2007). The rates of people who usually or always used sunscreen rose from 1992 to 2003 and then declined from 2003 to 2005. The recent decline in sunscreen use was steeper than any of the earlier rising periods.

The National Cancer Institute suggested that sun-protective behaviors differed by age, gender and education. Roughly 43 percent of individuals with ages 18 to 24 years old used one or more sun protective methods compared to 58 percent of those 25 years of age or older. Gender-wise, 47 percent of men versus 65 percent of women use some sun protective measures. Women reported using sunscreen more often than men (NCI Brief 6, 2007). Adults with lower educational level also reported less adherence to sun-safe behaviors (NCI(a), 2008). Specific sun-safe practices varied by ethnicity as well. Use of sunscreen was reported as the main sun-safe measure used by non-Hispanic Whites (33%) (NCI Brief 6, 2007).

These findings suggest that women are more likely to participate in strategies that would reduce their risk for developing skin cancer, however they are also more likely to engage in tanning behaviors. Age and education are positively related to involvement in sun-safe practices.

## Theoretical Framework

The theoretical support of this study is based on a multitude of approaches. The report uses the risk-as-feeling hypothesis and the model proposed by Honda (2004), which is depicted in Figure 1, as the main theoretical framework to understand the relationships between the proposed variables. Studies

have indicated that, along with knowledge, health information seeking behavior represents one of the best indicator of people's motivation or intention to adopt healthy behaviors. In addition, the main interest in health communication campaigns is behavioral change and consequently health research has focused on explaining the adoption or involvement in healthy behaviors. Since the model proposed by Honda (2004) lacks both health information seeking and behavioral outcome variables the present study will enhance the model by integrating both missing variables (Figure 2).

More specifically, the current study explores the background predictors of risk perception, feelings of worry, cancer knowledge and online health information seeking behavior and subsequently their impact on individuals' involvement in cancer-related behaviors. The main changes from the initial model (Honda, 2004) refer to (1) the inclusion of online health information seeking behavior as an intervening variable along with knowledge, (2) changing risk perception from an outcome to a predictor and (3) introducing health behaviors as the outcome.

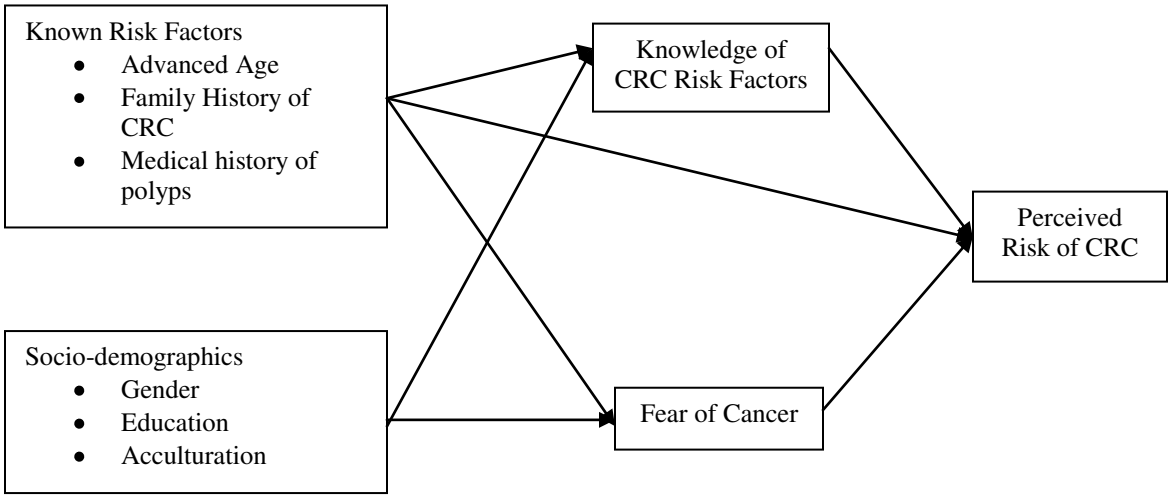



Figure 1. The Baseline Model of Perceived Risk, Honda (2004).

Additionally, in contrast to the previous study which focused on cultural differences related to risk appraisal and affective responses, this study explores gender differences in risk perception and emotional responses. It is expected that the model will yield different path coefficients for males compared to females on the proposed relationships.

Research on the role of affect on health decisions has been explored only partially. There is more to be revealed about the relationship between affective experience and likelihood of involvement in health related behaviors. Most of health research has centered on the influence of fear appeals on involvement in health protective behaviors. Additional research is needed to understand the still concealed role of emotions in health behaviors.

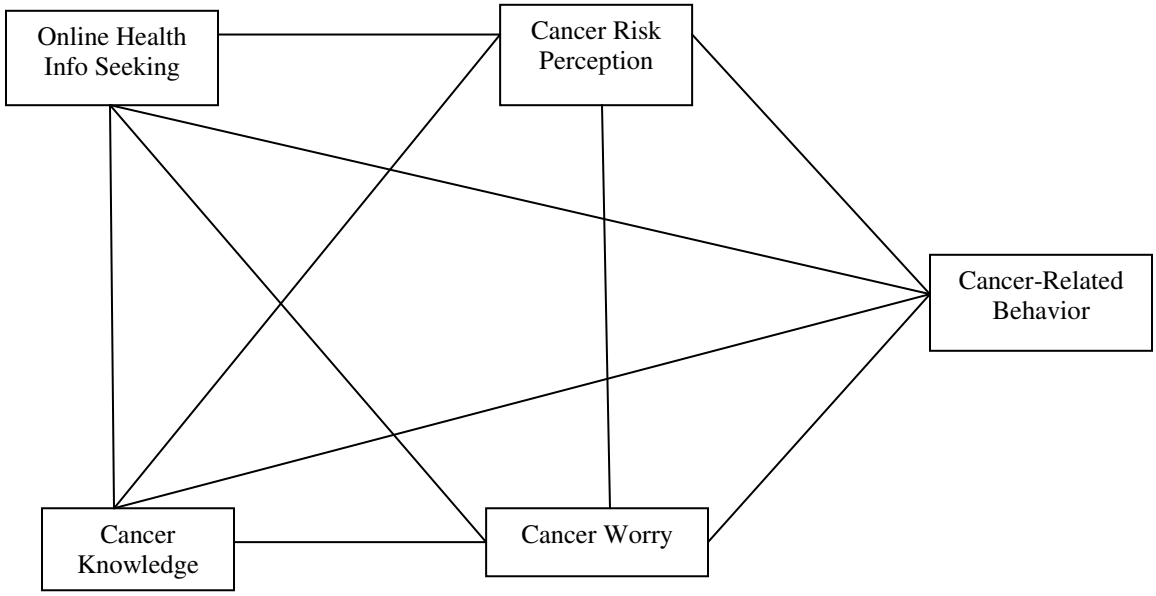



Figure 2. The Proposed Path Analytic Model for Lung, Colon and Skin Cancers, Controlling for Age, Race, Education and Personal/Family History of Cancer.

A unique aspect of this study refers precisely to the incorporation of affect in the form of worries in the health model. Researchers so far have overlooked this component and assumed that health attitudes and behaviors are based largely on logical thought. Moreover, most risk theories assume that people assess the desirability and efficacy of positive health outcomes and integrate this piece of information through some type of rational and expectation-based calculus to arrive at a decision (Loewenstein, Hsee, Weber and Welch, 2001). Nevertheless, Klein and Stefanek (2009) suggested that people's numerical and verbal judgments of risk are influenced by their affective state. Loewenstein,

Hsee, Weber and Welch (2001) suggested that people employ emotions to judge logical risk. These researchers examined an alternative theoretical perspective, the risk-as-feelings hypothesis, which highlighted the role of affect (worry in this case) in the development of health attitudes and adoption of health behaviors.

Within this framework, emotions play an informational role in the decision making process. They enhance the cognitive process by providing additional cues. Researchers have suggested that the quality of the decisions would be diminished when such reactions are not considered since affective responses are often more rapid and basic than cognitive evaluations (Slovic, Finucane, Peters and MacGregor, 2005; Damasio, 1994; Wilson et al., 1993). Gurmankin et al. (2005) concurrently noted that the relationship between worry and risk perceptions is not bidirectional and that worry actually impacts risk perceptions.

Researchers such as Epstein (1994) and Slovic, Peters, Finucane and MacGregor (2005) have tried to shed more light into the role of emotion on risk appraisal and decisions. Epstein (1994) suggested that people understand reality in two fundamental ways: experiential and analytical. The main underlying factor of the experiential approach is its affective basis. This approach is characterized by intuitive, nonverbal and experiential attributes while the analytical system is rooted in the deliberative, verbal and rational factors (Epstein, 1994; Slovic, Peters, Finucane and MacGregor, 2005). Furthermore, Slovic, Peters, Finucane and MacGregor (2005) portrayed the association between the two systems and risk perceptions. They indicated that, nowadays, risk can be perceived in two ways: as a feeling which represents individuals' intuitive and instinctive reactions and as analysis which employs logic, reason and scientific deliberation.

The two approaches operate in parallel and depend on each other for guidance (Slovic, Finucane, Peters, MacGregor, 2005). Researchers have characterized the active interplay between the analytic and the experiential systems as the "dance of affect and reason" (Slovic, Finucane, Peters and MacGregor, 2005; Finucane, Peters & Slovic, 2003). More importantly, Reventlow, Hvas and Tulinius (2001), suggested that while medical professionals' understanding of risk as statistical probability was more reliant on the analytical system, lay understanding may be more influenced by the experiential approach.

Myers (2005) demonstrated that men depended partly on affective factors when deciding whether or not to undergo prostate cancer screening. In addition, both men and women's decisions of undergoing genetic testing for colon cancer were influenced by affective factors. Schwartz, Peshkin, Tercyak, Taylor and Vladimarsdottir (2005) found concurrent results. They also suggested that "anxious and worried

individuals may base their decisions on their immediate affective impressions rather than on a careful analysis of the pros and cons…" (Schwartz, Peshkin, Tercyak, Taylor and Vladimarsdottir, p. S82, 2005). Others have indicated that interventions designed to correct inflated risk perceptions were ineffective if they were not accompanied by strategies to reduce cancer anxiety (Lerman et al., 1995).

Risk-as-feeling hypothesis has mostly explored the relationship between feelings and issues related to smoking and colon, breast and prostate cancer screenings. In addition, some studies have been found to examine the role of affect on involvement on health behaviors such as physical activity and sun-safe practices. This study attempts to expand the research related to risk-as-feelings hypothesis by exploring the relationship between risk as affect and risk as feeling and their predictive influence across multiple cancers and behaviors. This approach will be explored among females and males separately and within three types of cancers. Suggestions for future research in this area indicated that risk-as-feelings hypothesis could provide helpful information on gender differences and risk perception (as reason and as affect).

Finally, the proposed model resembles parts from other health communication theories such as the health belief model, the protection motivation theory, and the extended parallel process (Hochbaum, 1958 Rogers 1975, Conner & Norman, 2005). In this framework, risk perception can operate as general representations of perceived susceptibility; and worry and knowledge can resemble perceived severity, perceived control or self-efficacy.

## Hypotheses

The current literature has yielded several patterns with regards to cancer related practices, online health information seeking behaviors, cancer-related knowledge, risk perceptions and feelings of worry. Studies generally suggested that health information seeking behaviors and knowledge are important determinants of individuals' involvement in cancer related practices. Active health information seekers and knowledgeable individuals tend to engage in more frequent health practices. As a result they tend to worry less and have lower risk perceptions. Among females, however, more knowledge and active health information seeking behaviors are not necessarily conductive to fewer worries or lower risk perceptions. Despite being more aware and prepared to comprehend health matters, females continue to experience high levels of worry and risk perceptions.

Studies indicated mixed results with regards to risk perception, feelings of worry and adoption cancer protective behaviors. Results suggested that higher risk perceptions can be associated with

positive actions towards healthier lifestyles. Similarly, due to optimistic bias, risk perceptions can also be related to maintenance of negative behaviors. Findings associated with negative affect were unclear. They indicated that increased feelings of worry could generate positive health actions but also inhibit those activities. There was no common agreement on the type of health response negative affect yielded.

Research on involvement in cancer related behaviors suggested females engaged in more frequent sunscreen applications, while males reported higher levels of physical activity and smoking. Based on these patterns the following hypotheses are proposed:

Lung Cancer:

H1: Controlling for age, race, education and cancer history,

a. Lung cancer knowledge is positively related to online health information seeking.
b. Among males, lung cancer risk perceptions are negatively related to lung cancer knowledge and online health information seeking and positively related to worry about developing lung cancer.
c. Among females, lung cancer risk perceptions are positively related to lung cancer knowledge, online health information seeking, and worry about developing lung cancer.
d. Among males, worry about developing lung cancer is negatively related to lung cancer knowledge and online health information seeking.
e. Among females, worry about developing lung cancer is positively related to lung cancer knowledge and online health information seeking.
f. Cigarette smoking is positively related to lung cancer knowledge, online health information seeking, lung cancer risk perceptions and worry about developing lung cancer.

Colon Cancer:

H2: Controlling for age, race, education and cancer history,

a. Colon cancer knowledge is positively related to online health information seeking.
b. Among males, colon cancer risk perceptions are negatively related to colon cancer knowledge and online health information seeking and positively related to worry about developing colon cancer.

c. Among females, colon cancer risk perceptions are positively related to colon cancer knowledge, online health information seeking, and worry about developing colon cancer.
d. Among males, worry about developing colon cancer is negatively related to colon cancer knowledge and online health information seeking.
e. Among females, worry about developing colon cancer is positively related to colon cancer knowledge and online health information seeking.
f. Exercising is positively related to colon cancer knowledge and online health information seeking, and negatively related to colon cancer risk perceptions and worry about developing colon cancer.

Skin Cancer

H3: Controlling for age, race, education and cancer history,

a. Skin cancer knowledge is positively related to online health information seeking.
b. Among males, skin cancer risk perceptions are negatively related to skin cancer knowledge and online health information seeking and positively related to worry about developing skin cancer.
c. Among females, skin cancer risk perceptions are positively related to skin cancer knowledge, online health information seeking, and worry about developing skin cancer.
d. Among males, worry about developing skin cancer is negatively related to skin cancer knowledge and online health information seeking.
e. Among females, worry about developing skin cancer is positively related to skin cancer knowledge and online health information seeking.
f. Sunscreen usage is positively related to skin cancer knowledge, online health information seeking, skin cancer risk perceptions and worry about developing skin cancer.

The hypotheses in this study will be tested following the introduction of the control variables, age, race, education and history of cancer.

# CHAPTER III
# METHODOLOGY

This study is a secondary analysis of the 2005 Health Information National Trends Survey (HINTS). This section discusses the background details and the data collection procedure of the 2005 HINTS, the questionnaire items, the sample characteristics and the weighting method. The chapter concludes with a description of the measures and data analysis procedures employed in this study.

## Background

The National Cancer Institute (NCI), through the Health Communication and Informatics Research Branch and the Division of Cancer Control and Population Science, conducted the first HINTS in 2003. The 2003 HINTS assessed cancer-related knowledge, attitudes, and behaviors as well as access to and use of communication channels among the general adult U.S. population. Upon completion of the first HINTS, the NCI decided to continue funding the study every two years. The HINTS 2005 questionnaire enhanced the initial instrument by exploring other topics including scanning and seeking health information, self-efficacy in seeking health information, doctor-patient communication and specific cancer modules. The constant surveillance of cancer-related knowledge and behaviors, through the HINTS series, allows health professionals to track the success of cancer intervention programs and the changes in cognitive and behavioral outcomes (HINTS, 2005).

## Data Collection

The survey was administered to a cross-sectional sample of the U.S. civilian, non-institutionalized, adult population (HINTS, 2005). The data collection started in February and ended in August of 2005. The study used a probability sample, based on random digit dialing (RDD) of all telephone exchanges in the U.S. This method was expected to provide the most unbiased population estimates of the prevalence of cancer-relevant knowledge, attitudes, and behaviors among the U.S. population.

The questionnaire started with a household screener which indentified eligible respondents. It continued with the extended interview portion which captured communication related habits as well as cancer-related knowledge and behaviors. One adult per household, 18 years of age or older was sampled and administered the extended interview. The household screener was conducted over the telephone on

its entirety. For the extended interview, the participants were randomly divided into two groups: one that received the extended interview over the telephone and another where respondents could select their preferred mode of answering the questionnaire between the telephone and the Internet. Respondents were also offered three levels of incentives: $0, $5, and $15 (HINTS, 2005).

## Questionnaire Items

The extended interview began with core questions on participants' health communication habits. This part determined respondents' use and preferences of various communication media outlets. Later, the questions addressed participants' individual and family histories of cancer and their health information-seeking behaviors. In addition, this portion explored other topics such as barriers to seeking information and respondents' source preferences and source recognition.

The next section assigned respondents to certain cancer paths depending on their age and gender. This portion included in depth questions about prostate and cervical cancer and more limited questions related to breast, colon and skin cancers. Once this segment concluded, respondents were randomly assigned to one of three cancer units: lung, colon or skin cancer. Throughout this next session, respondents answered questions related to their opinions of the screening, preventability, treatability and manageability of one of the three types of cancers. Each respondent answered only one unit. The survey converged at the end with a round of common questions about cancer related behaviors such as tobacco use, dieting, exercising and general health status. The questionnaire ended with participants' demographic information. Once the demographic characteristics were collected, participants were debriefed about the scope of the questionnaire.

## Sample Characteristics

The final 2005 sample included 5,586 participants. Of those, 1,872 were assigned to the lung cancer unit (625 males and 1,247 females), 1,978 individuals to the colon cancer unit (693 males and 1,285 females), and 1,736 to the skin cancer unit (611 males and 1,125 females). The final weighted sample changed the number of individuals in each gender group to 860 males and 1,012 females among lung cancer respondents, 949 males and 1,029 females among colon cancer respondents and 874 males and 862 females among skin cancer respondents.

The screener response rate was 34.0 percent, while the extended interview response rate was 61.3 percent. The overall response rate was 20.8 percent.

## Weighting

Every sampled respondent in the 2005 HINTS data received a sampling base weight and a set of replicate Jackknife weights. The base weight was the result of four factors: (1) the inverse probability of the household being selected in the sample, (2) a factor of 1.456 if the household had a non-mailable address (the non-mailable numbers were subsampled at a rate of 68.7 percent; 1.456 was used to offset this subsampling), (3) the inverse probability of an adult being selected in the sample (which is equal to the number of adults in the household) and (4) an extra factor of 2 if the household had more than one telephone numbers.

In addition to the base weight, the study design also employed non-response and post-stratification adjustments. Non-response bias reduces the effective sample size and increases the sampling variance which can lead to biased estimators. If there were consistent differences between those who decided to respond to the 2005 HINTS and those who decided not to participate, estimators would be biased. Thus, the researchers included non-response weights in the analysis.

The design included two methods to adjust for non-response, the screener and the extended interview non-response adjustments. For the screener, the non-response weights took into consideration four characteristics: (1) the time of the telephone number released to the study (earlier, midway, latest), (2) the mailable status, (3) the percentage of college graduates and (4) the percentage of African Americans and Hispanics. The extended interview non-response adjustment was calculated using characteristics such as (1) the screener (yes or no), (2) the number of adults in the household (one or more), (3) the sex of the sampled person (male or female), (4) the promised incentives ($0, $5, $15), (5) the extended interview mode groups (telephone or Internet) and (6) the mailable and nonmailable status.

Similarly, post-stratification adjustments were used to reduce the sampling variance of estimators by employing reliable auxiliary information. This piece of information usually comes from more reliable sources that exhibit less sampling error compared to the collected data. The auxiliary information used for the 2005 HINTS data came from the 2005 Current Population Survey. The auxiliary characteristics for the post-stratification adjustments were based on sex, race, age and education. The final sampling weight for each respondent was the product between the base weight, the non-response weight and the post-stratification adjustment.

Aside from the final sampling weight which helped assure accurate representation of U.S. adults in the sample, a Jackknife replication technique was used to create additional weights that would help

provide an unbiased estimate of the sample variance. Each adult in the 2005 HINTS data was assigned 50 replicate weights. This technique began by selecting subsets (replicates) of the sample data. Then, for each replicate and for each respondent in the replicate, it determined a Jackknife sampling weight, as if the replicate were the entire sample (the replicate was actually the entire sample minus 1/50 of respondents which were deleted). If the household was in the replicate, the initial Jackknife replicate weight for each sampled adult was equal to 50/49 times the base weight (described above); if the household was not in the replicate, but instead was in the deleted subset for that replicate, the initial Jackknife replicate weight was equal to zero. The final Jackknife replicate weight was the product between the initial Jackknife weight, the non-response weight and the post-stratification adjustment. A detailed description of the mathematical computation of the weights as well as further explanations of the sample design can be found in the Final Report of the HINTS study on the official website of the National Cancer Institute (HINTS, 2005).

## Limitations

Employing the final sampling weight along with the 50 Jackknife replicate weight yields unbiased estimators for the parameters of interest as well as unbiased variance estimations. However, the available statistical software cannot support the use of a Jackknife weighting procedure and a path analytic model simultaneously. Consequently, the National Cancer Institute suggested a different variance estimation approach which included three recommendations: (1) the inclusion of a stratification variable for every respondent, (2) the inclusion of a clustering variable which should be the case identification number found in the 2005 HINTS database and (3) the inclusion of a weighting variable which should be the existing final sampling weight also found in the 2005 HINTS database.

This methods yields reasonably unbiased parameter estimates (Brogan, 1998). Nevertheless, it comes with certain constraints that yield approximate sampling variances. These constraints refer to the potential difference between a systematic and a simple random sample and the absence of the adjustment factors and the auxiliary information included in the Jackknife replicates. As a result, the analysis may yield conservative estimates of sampling errors (Brogan, 1998, Stapleton, 2008). Despite this limitation, this approach has been employed by other researchers in this area and is considered a viable option for complex statistical procedures (Stapleton, 2008; Walker & Young, 2003). Currently, researchers are attempting to develop software and programs that can allow for concurrent use of complex weighting

procedures and complex procedures such as SEM applications (Stapleton, 2008). However, efforts are at the beginning.

## Measures

The 2005 HINTS data set contains three separate files, the lung cancer, colon cancer and skin cancer file. This was necessary because individuals who responded questions for the lung cancer module did not answer the questions for the colon and skin cancer modules. Consequently, for the purpose of this study, all analyses were repeated three times based on the different cancer modules.

A total of six indices were created to capture individuals' online health information seeking behavior as well as their cancer-related knowledge. Each cancer module, lung, colon and skin, included one summed index assessing the online health information seeking behavior and one assessing specific cancer-related knowledge. Forty-six items were combined into these six indices. Each item represented a dichotomous variable. Positive responses indicated cancer knowledge and active online health information seeking behaviors. All positive responses were added to form the summed indices.

The Kuder – Richardson Formula 20 (KR20) was employed to determine the internal consistency for the dichotomous items that comprised the indices. The KR20 coefficient is a special case of Cronbach's alpha (Pedhazur & Schmelkin, 1991). Both KR-20 and Cronbach alpha are computed in the same manner and yield the same results in SPSS (Reinard, 2006). Table 2 describes online health information and cancer-related knowledge indices indicating the sample size, the number of items used to construct the scales and the unstandardized KR20 reliability coefficients for each index.

The three online health information seeking summed indices had reliabilities above 0.80 and were considered acceptable for applied research (Nunnally, 1967; Pedhazur & Schmelkin, 1991). The three cancer related knowledge indices had relatively low reliabilities (lung cancer knowledge, KR20 = 0.583; colon cancer knowledge, KR20 = 0.650; skin cancer knowledge, KR20 = 0.706). These low reliability values are below what would normally be considered acceptable. Nonetheless, prior health research suggests KR20 for knowledge indices are generally lower compared to other health-related indices.

Table 1. The Kuder-Richardson 20 (KR20) Reliabilities for the Weighted Summed Unstandardized Indices

| Indices | Sample (n) | Number of Items | KR20 Coefficients |
|---|---|---|---|
| Online Health Information Indices | | | |
| Lung Cancer | 1,872 | 5 | 0.891 |
| Colon Cancer | 1,978 | 5 | 0.881 |
| Skin Cancer | 1,736 | 5 | 0.877 |
| Cancer Knowledge Indices | | | |
| Lung Cancer | 1,872 | 11 | 0.583 |
| Colon Cancer | 1,978 | 9 | 0.650 |
| Skin Cancer | 1,736 | 11 | 0.706 |

The cancer knowledge reliability coefficients in this study are similar to other KR20 reliability coefficients reported in previous health research. Numerous studies have used health knowledge reliability coefficients between 0.50 and 0.70. For instance, Stanger's (1993) KR20 for the breast cancer knowledge scale was 0.60 and for curability knowledge scale was 0.62. Boehm (1995) found that the KR20 coefficient for the Prostate Cancer Screening Knowledge Inventory was as low as .45 for the pre-test and .58 for the post-test. Likewise, Mishel (2003) indicated that the prostate cancer knowledge scale in their study yielded a KR20 of 0.67. Based on these findings, the cancer-related knowledge indices in this study are considered acceptable.

Kerlinger and Lee (2000) indicated that one of the reasons for low internal consistency for the knowledge scales can surface because the items measure different aspects of knowledge. This multidimensionality cannot be captured by a single reliability coefficient. Boehm (1995) concurs. In addition, DiLorio (2005) further suggested that the KR20 reliability coefficient of a test can be underestimated if the test items have different levels of difficulty. An analysis of item difficulty levels for this study indicated that indeed the items had different difficulty ranging from 0.25 to 0.85. This could have lowered the KR20 reliability coefficients as well.

The three knowledge indices in this study varied also in terms of the questions included in each of them. While the three online health information seeking behavior indices depicted the same five items for each of the cancer modules, the knowledge indices highlighted different content to assess

respondents' familiarity with the specific cancers. More specifically, each module highlighted a separate set of symptoms and reducing strategies that were specific to the type of cancer supported by the module and a common set of items that assessed general cancer knowledge.

The details associated with the six indices can be summarized as follows:

*Online Health Information Seeking for Lung Cancer* (KR20 = 0.891),
*Online Health Information Seeking for Colon Cancer* (KR20 = 0.881),
*Online Health Information Seeking for Skin Cancer* (KR20 = 0.877).

Each of these indices combine responses to five survey items regarding (1) seeking health or medical information for oneself, (2) seeking health or medical information for others, (3) seeking information about exercising, (4) seeking information about diet and (5) seeking information about other health topics.

*Lung Cancer-Related Knowledge* (KR20 = 0.583).

This index combines responses to 11 questionnaire items regarding symptoms such as (1) shortness of breath and (2) coughing; strategies to reduce chances of getting cancer including (3) not smoking, (4) avoiding second hand smoke and (5) avoiding pollution ; and general cancer related statements such as (6) "people with lung cancer would have pain or other symptoms prior to being diagnosed," (7) "there's not much you can do to lower your chances of getting lung cancer," (8) "lung cancer develops over a period of several years," (9) "there are ways to slow down or disrupt the development of lung cancer," (10) "lung cancer is most often caused by a person's behavior or lifestyle," and (11) "getting checked regularly for lung cancer increases the chances of finding cancer when it's easy to treat."

*Colon Cancer-Related Knowledge* (KR20 = 0.650).

This index combines responses to nine questionnaire items regarding symptoms such as (1) blood in the stool; strategies to reduce chances of getting cancer including (2) eating healthy; available tests to check for polyps such as (3) colonoscopy and (4) stool test; and general cancer related statements such as (5) "people with colon cancer would have pain or other symptoms prior to being diagnosed," (6) "there's not much you can do to lower your chances of getting colon cancer," (7) "colon cancer develops over a period of several years," (8) "there are ways to

slow down or disrupt the development of colon cancer," (9) "getting checked regularly for colon cancer increases the chances of finding cancer when it's easy to treat."

*Skin Cancer-Related Knowledge* (KR20 = 0.706).

This index combines responses to 11 questionnaire items regarding symptoms such (1) changes in mole size, shape or form and (2) pigment discoloration; strategies to reduce chances of getting cancer including (3) wearing protective clothing, (4) staying out of the sun and (5) applying sunscreen; and general cancer related statements such as (6) "people with skin cancer would have pain or other symptoms prior to being diagnosed," (7) "there's not much you can do to lower your chances of getting skin cancer," (8) "skin cancer develops over a period of several years," (9) "there are ways to slow down or disrupt the development of skin cancer," (10) "skin cancer is most often caused by a person's behavior or lifestyle," (11) "getting checked regularly for skin cancer increases the chances of finding cancer when it's easy to treat."

In addition to these indices, the proposed research hypotheses focused on other factors including individuals' risk perceptions and negative affect (worry) related to cancer development, and depending on the module, cancer-related behaviors. These latter behaviors included the number of cigarettes smoked in the past 30 days, the number of minutes of exercise per week and the frequency of sunscreen applications.

*Perception Variables*

*Risk perceptions.*

A single item assessed individuals' perceptions about their likelihood of developing cancer in the future (lung, colon or skin cancer depending on the module). The exact question was: "How likely do you think it is that you will develop [lung/colon/skin] cancer in the future?" This item was measured on five-point Likert-type scale ranging from very low to very high.

*Negative Affect (Worry).*

A single item was used to capture individuals' levels of worry towards developing cancer in the future (lung, colon or skin depending on the module). The exact question was: "How often do

you worry about getting [lung/colon/skin] cancer?" This item was measured on four-point Likert-type scale ranging from never to always.

*Cancer-Related Practices*

*Smoking.*

Assessed the number of cigarettes smoked in the past 30 days. Never smokers, former smokers and current smokers were all captured through this measure. Never and former smokers (regardless of how long or how recent) received a score of zero, whereas current smokers received their reported number of cigarettes smoked. This measure ranged from 0 to 600 cigarettes.

*Exercise.*

Assessed respondents' amount of moderate to vigorous physical activity per week (in minutes). The 2005 HINTS instrument did not specifically define moderate to vigorous physical activity. The Centers for Disease Control and Prevention, however, identifies brisk walking as moderate level activity and jogging or running as vigorous level of physical activity (CDC-Physical Activity for Everyone, 2008).

Seven individuals in the sample reported between 4,600 and 7,600 minutes of exercise per week, which results into 11 hours of daily physical activity. Even if individuals have jobs that require continuous physical activity it is believed that these values are not representative. As a result, a winsorizing technique was employed to adjust for these extreme outliers. This procedure is similar to trimming, however, instead of discarding the extreme values, they are replaced by the remaining extreme values (low and high) (Reinard, 2006). This way the extreme values are moved toward the centre of the distribution adjusting for the inflated variability created by the outliers. This technique is sensitive to the number of outliers, but not to their actual values. Initially, the amount of weekly exercise ranged from 0 to 7,600 minutes. After the winsorinzing technique was applied, the amount of weekly exercise ranged from 0 to 3,600 minutes.

*Sunscreen Usage.*

This measure captured respondents' frequency of sunscreen applications. The item was measured on five-point Likert-type scale ranging from never to always.

*Control Variables (Demographic Characteristics)*

*Age:* In years.

*Sex.* Male/Female.

*Race.* Two categories - Caucasian and Other.

*Education.* Seven categories - never attended school, middle school or less, some high-school, high-school graduate, some college, college graduate and post-graduate degree.

*Cancer History (Pers. /Fam.).* Two categories – Yes/No. Assessed if respondents had personal or family histories of cancer.

## Statistical Procedures

The data is analyzed primarily to determine the extent to which the proposed model and the risk-as-feeling hypothesis explain variation in the adoption of cancer reducing strategies comparing gender groups. To test similar relationships between exogenous and endogenous variables, communication researchers have used structural equation modeling (SEM) (Holbert & Stephenson, 2002).

Stephenson, Holbert and Zimmerman (2006) noted some of the conceptual advantages of employing SEM as a statistical tool in health communication research. They indicated that SEM allowed researchers to visualize and analyze communication as a process and not as individual sections of a larger concept. In addition, it represented an important tool to analyze a system of equations that could underline a theoretical communication process. This would be possible because SEM allows for full-information maximum likelihood estimation which determines if a proposed model is consistent with the observed data. This method is contrasting the multiple regression approach which employs partial-information ordinary least squares estimators that determine individual relationships solely.

Another important contribution of the SEM technique to the study of health communication lies in its ability to place health communication as a predictor, mediator and outcome (Stephenson, Holbert and Zimmerman, 2006). Employing SEM as a statistical tool to study health communication processes can enhance the understanding of communication as a complex set of interactions rather than an isolated incident (Parrott, 2004).

Even though SEM permits testing of latent variables in the model, the current research will focus on the main constructs of the structural model, the path analytic model, excluding the measurement model. The main aim of this study is to test the fit of the model and to explore the relationships between the main predictors and the predicted variables, thus a path analysis is appropriate. The main drawback

of excluding the measurement model from the SEM analysis is the assumptions that all the variables included in the model are measured without error.

Two software packages are used to conduct these analyses: SPSS and Mplus. SPSS is used to generate the reliability coefficients. Mplus is used to test the goodness-of-fit of the proposed models and to estimate the path coefficients for those models. In both instances, a sample weighting factor is included in the analysis.

The Maximum Likelihood with Robust Standard Errors (MLR) method of estimation is used to obtain the path analysis results in Mplus. The MLR is a commonly used approach to test relationships between endogenous and exogenous variables in models with complex data designs (Muthen, 2009). In addition, this method is also robust to non-normality or measurement violations (Muthen, 2009). This method provides an adjusted chi-square statistic. Initially, MLR yields a regular chi-square value which is then divided by a constant k whose value is a function of the residual weight matrix, the observed multivariate kurtosis and the degrees of freedom for the model (Hoyle, 1995). Based on this scaling, as the degree of multivariate kurtosis increases the constant k increases as well which results into a larger adjustment of the regular chi-square value.

This adjustment factor attempts to capture the degree to which the regular chi-square statistics is rescaled. If the scaling adjustment factor is 1.0, there is no multivariate kurtosis and the chi-square has not been rescaled. The extent to which the correction factor is higher than 1.0, there is a basis for some multivariate kurtosis. Unfortunately, currently there is no conventional cutoff value for the scaling correction factor that would indicate severe non-normality. Nevertheless, the scaling factors for all the models in this study range from approximately 1.52 to 1.78 which could indicate that non-normality is not severe.

In addition to adjusting the chi-square statistics, this approach adjusts the standard errors for the degree of multivariate kurtosis as well (Hoyle, 1995). To that end, Finney and Distefano (2006) offered support for the use of MLR with Satorra-Bentler scaling factor if the data is moderately non-normal and variables have at least four categories.

This study also employs a multiple group comparison. The multiple group comparison technique in Mplus involves estimating the same proposed model for two sub-samples simultaneously. Basically, this study explores if the proposed relationships between exogenous and endogenous variables are identical for males and females for the three types of cancer.

The first step in multiple group comparison analysis involves a technique where all model paths between the two samples are allowed to vary (the unconstrained model). The fit of the model is assessed and if the fit is acceptable the analysis continues. If not, this initial model must be reestimated until a good model fit is achieved. The next step involves conducting the same simultaneous comparison between males and females but with all paths between the two sub-samples constrained to be equal (the fully constrained model). A chi-square different test is conducted to determine which model is better. A significant chi-square difference indicates that the complex model (with all unequal paths) is better than the simple model (with all equal paths) and therefore the former should be kept. A non-significant chi-square indicates just the opposite where the simple model is better.

If the chi-square difference test between the unconstrained and the fully constrained models is not significant, other models (partially constrained models) are developed to be compared to the fully constrained one. Any subsequent models will be compared with the antecedent models using a chi-square difference test and applying the same principle of significance until a final parsimonious model is reached.

A Satorra-Bentler scaled chi-square difference test is used to determine if there is evidence that the complex model (the one with unequal paths) fits the data better than the simple model (the one with constrained paths), where the simple model is nested within the complex one. This scaled chi-square difference test varies from the regular chi-square difference test through the use of the correction factor.

In addition, several fit indices are used to determine the fit of the models: the chi-square statistics, the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean squared error of approximation (RMSEA) and the standardized root mean square residual (SRMR). To support a good model fit, the analysis should yield a non-significant chi-square value, a CFI and TLI higher than 0.90 and an RMSEA and SRMR lower than 0.05 (Kline, 2005).

Each of these indices highlights slightly different concepts and computations. The chi-square ($\chi 2$) goodness-of-fit index provides a measure of the overall fit of the model. This coefficient represents a fitting function and tests whether the observed variance-covariance matrix is consistent with a specified model. However, the chi-square estimate is influenced by a large sample size which is highly desirable in SEM analyses (Hoyle, 1995). Therefore, additional indices that are less sensitive to sample size are used.

The CFI assesses the relative improvement in fit of the proposed model compared to a baseline model which assumes zero population covariance among the observed variables (Kline, 2005).

Similarly, the Tucker-Lewis index compares the proposed model against the null or baseline model but takes into account the degrees of freedom as well (Hoyle, 1995). The CFI and TLI range from zero to one, however the TLI index can sometimes fall outside this range (Kline, 2005).

The RMSEA represents an index that is computed as a function of the degrees of freedom and takes into consideration the parsimony of the model and the number of model parameters in comparison with the measured variables. This is actually a badness-of-fit index which means that higher value for this index suggests bad fit. The SRMR index is based on the difference between the observed and predicted covariances, the covariance residuals. For a good model fit these residuals should be close to zero as well (Kline, 2005).

The alpha level for all statistical analyses is set to 0.05 (one-tail). Lastly, the coefficient of determination in health communication research can be relatively small (Holbert and Stephenson, 2002). Since, most of communication and social science outcomes are a result of a complex array of variables, a coefficient of determination equal to five percent can be considered of significant importance (Jaccard, 1998). Consequently, the relative importance of the r-squared ($R^2$) coefficient will be determined within the context of the model without pre-establishing a cutoff point.

# CHAPTER IV
# RESULTS

This chapter provides a summary of the survey data, the fit indices for the proposed models and the path analysis coefficients. As previously mentioned, the weighted total sample yielded 860 males and 1,012 females for lung cancer, 949 males and 1,029 females for colon cancer and 874 male and 862 females for skin cancer.

## Lung Cancer Results

### Descriptive Analysis

Table 2a provides a demographic description of the lung cancer respondents. In addition, it also includes descriptive analyses of other variables used in the model including respondents' history of personal or family cancer, lung cancer knowledge, online health information seeking behavior, lung cancer risk perceptions, lung cancer worry, and recent cigarette smoking (past 30 days).

The mean age of the entire sample is 45.8 (SD = 17.47) years old. The mean age of females (M = 46.64; SD = 17.84) is slightly higher than that of males (M = 44.96; SD = 16.98). The majority of respondents in the overall lung cancer sample (70.5%), as well as in the male (67.6%) and female (73.0%) sub-samples, are Caucasian. A high school degree is representative for the largest percentage of individuals in the overall sample (34.3%) and in the male (33.4%) and female (35.0%) sub-samples. A large majority of males and females report a history of personal or family cancer (67.2% and 78.4% respectively).

Table 2a. Weighted Descriptive Statistics for the Lung Cancer Sample Respondents: Demographics, Cancer History, Risk Perception, Cancer Worry, Knowledge Index, Online Health Information Seeking Behavior and Cigarette Smoking

| | | Total Sample | Male Sample | Female Sample |
|---|---|---|---|---|
| | | n = 1,872 | n = 860 | n = 1,012 |
| **Control Variables** | | | | |
| Age | | | | |
| | Mean | 45.87 | 44.96 | 46.64 |
| | Std. Deviation | 17.47 | 16.98 | 17.84 |
| | Median | 45.00 | 44.00 | 46.00 |
| | Mode | 46.00 | 57.00 | 19.00 |
| | Minimum | 18.00 | 18.00 | 18.00 |
| | Maximum | 95.00 | 95.00 | 94.00 |
| Race | | | | |
| | Other | 29.50% | 32.40% | 27.00% |
| | Caucasian | 70.50% | 67.60% | 73.00% |
| Education | | | | |
| | Never Attended School | 0.05% | 0.10% | 0.00% |
| | Middle School or Less | 4.77% | 6.06% | 3.70% |
| | Some High School | 7.84% | 9.17% | 6.72% |
| | High School Graduate | 34.30% | 33.44% | 35.02% |
| | Some College | 28.74% | 27.26% | 29.99% |
| | College Graduate | 15.57% | 14.17% | 16.74% |
| | Post-Graduate Degree | 8.73% | 9.80% | 7.83% |
| Cancer History (Pers./Fam.) | | | | |
| | No | 26.80% | 32.80% | 21.60% |
| | Yes | 73.20% | 67.20% | 78.40% |
| **Predictor/Predicted Variables** | | | | |
| Lung Cancer Knowledge Index | | | | |
| | Mean | 6.87 | 6.77 | 6.95 |
| | Std. Deviation | 2.11 | 2.17 | 2.05 |
| | Median | 7.00 | 7.00 | 7.00 |
| | Mode | 8.00 | 8.00 | 8.00 |
| | Minimum | 0.00 | 0.00 | 0.00 |
| | Maximum | 11.00 | 11.00 | 11.00 |

Table 2a cont. Weighted Descriptive Statistics for the Lung Cancer Sample Respondents: Demographics, Cancer History, Risk Perceptions, Cancer Worry, Knowledge Index, Online Health Information Seeking Behavior and Cigarette Smoking

| | | Total Sample | Male Sample | Female Sample |
|---|---|---|---|---|
| | | n = 1,872 | n = 860 | n = 1,012 |
| **Predictor/Predicted Variables** | | | | |
| Online Health Info Seeking Behavior | | | | |
| | Mean | 1.69 | 1.39 | 1.95 |
| | Std. Deviation | 1.97 | 1.83 | 2.04 |
| | Median | 0.00 | 0.00 | 1.00 |
| | Mode | 0.00 | 0.00 | 0.00 |
| | Minimum | 0.00 | 0.00 | 0.00 |
| | Maximum | 5.00 | 5.00 | 5.00 |
| Lung Cancer Risk Perception | | | | |
| | Very low | 46.39% | 46.02% | 46.71% |
| | Somewhat low | 22.37% | 22.18% | 22.53% |
| | Moderate | 19.00% | 18.92% | 19.07% |
| | Somewhat high | 7.37% | 7.40% | 7.35% |
| | Very high | 4.86% | 5.49% | 4.34% |
| Lung Cancer Worry | | | | |
| | Rarely or never | 76.89% | 76.98% | 76.81% |
| | Sometimes | 17.17% | 16.80% | 17.47% |
| | Often | 2.97% | 2.67% | 3.23% |
| | All the time | 2.97% | 3.55% | 2.48% |
| Cigarettes Smoked in the Past 30 Days | | | | |
| | Mean | 6.61 | 8.39 | 5.11 |
| | Std. Deviation | 30.20 | 38.81 | 20.13 |
| | Median | 0.00 | 0.00 | 0.00 |
| | Mode | 0.00 | 0.00 | 0.00 |
| | Minimum | 0.00 | 0.00 | 0.00 |
| | Maximum | 600.00 | 600.00 | 300.00 |

As expected females, compared to males, have a somewhat higher mean score for the lung cancer knowledge and online health information seeking behavior indices. The two gender groups are very

similar in their risk perceptions and worries about developing lung cancer. Slightly less than half of males (46.0%) and females (46.7%) report very low risk perceptions and roughly three quarters of males (76.98%) and females (76.81%) report worrying about lung cancer rarely or never. In terms of cancer-related behavior, males, compared to females, report higher mean scores for cigarettes smoked in the last 30 days; males smoke on average 8.39 (SD = 38.81) cigarettes while females smoke on average 5.11 (SD = 20.13) cigarettes.

**Path Analysis**

Model modifications were conducted gradually using an interactive process that involved adding new paths based on the chi-square reduction indices printed in the Mplus output and removing non-significant paths. Consequently, the resulting model was reestimated to reach a final parsimonious model. All added effects were included only if they were theoretically plausible.

Figure 3 and Table 2b depict the path analysis results and the five fit indices for the unconstrained and the final/fully constrained model. In addition, Table 2b also highlights the Satorra-Bentler chi-square difference test coefficient which shows that the fully constrained/final model is statistically better that the unconditional model. Additional partially constrained models were developed and compared to the fully constrained one, however, the Satorra-Bentler chi-square difference test coefficients were non-significant suggesting that none of the new models were statistically better than the fully constrained model. The five indices that assessed the fit of the final model indicate a good fit: $X^2_{43}$ = 40.239 (p = .592); CFI = 1.000; TLI = 1.005; RMSEA = 0.000; SRMR = 0.024.

In a multiple group comparison analysis the equality/inequality constraints between males and females are applicable solely to the unstandardized paths, thus, Figure 2 depicts the final model with the unstandardized coefficients and the statistically non-significant paths removed. The parameters are unequal in the standardized solution as the sub-samples have different variabilities. The standardized coefficients are sample-specific, hence, it is inappropriate to compare them across samples. However, the standardized solutions can be used to compare the relative importance of predictors within each group since the unstandardized solution is affected by the measurement of the variable and cannot capture the magnitude of the predictor variables on the outcome.

Table 2b. The Fit Indices[1] and the Satorra-Bentler $X^2$ Difference Test Coefficient[2] for the Lung Cancer Nested Models

| Model | $X^2$*(df, p-value)* | CFI | TLI | RMSEA | SRMR | Satorra-Bentler $X^2$ Difference Test Coefficient (df, p-value) |
|---|---|---|---|---|---|---|
| The Unconstrained Model[3] | 26.724 (26, 0.42) | 0.999 | 0.998 | 0.005 | 0.019 | |
| The Fully Constrained Model (Final Model)[4] | 40.239 (43, 0.59) | 1.000 | 1.005 | 0.000 | 0.024 | |
| The Unconstrained Model vs. the Fully Constrained Model | | | | | | ***6.90 (17, > .05)*** |

Additional partially constrained models, where certain paths were allowed to vary between males and females, were developed and compared with the final model. The Satorra-Bentler $X^2$ difference test yielded non-significant chi-squares indicating that the final model fits the data the best.

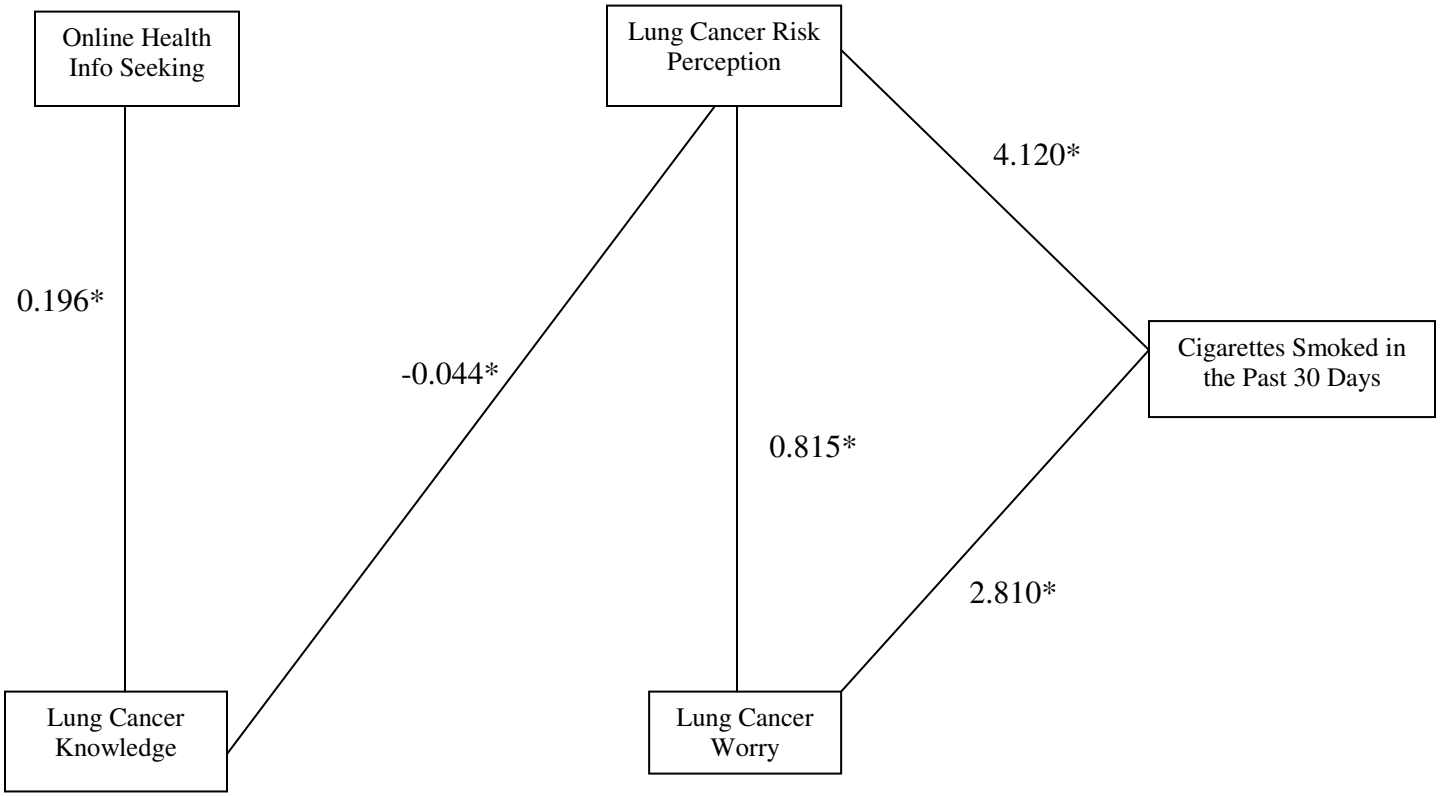
[1] Interpretation Criteria for the Fit Indices: non-significant $X^2$, CFI and TLI coefficients greater than 0.90 and RMSEA and SRMR coefficients lower than 0.05 indicate good model fit.

[2] Interpretation Criteria for the Satorra-Bentler $X^2$difference test: significant $X^2$ difference test indicates that the more complex model (with freely estimated paths between males and females) fits the data better than the simpler model (with equal paths between males and females); thus, the more complex model should be kept. Non-significant $X^2$ difference test indicates that the simpler model should be retained.

[3] The Unconstrained Model = all model paths between males and females were allowed to vary.

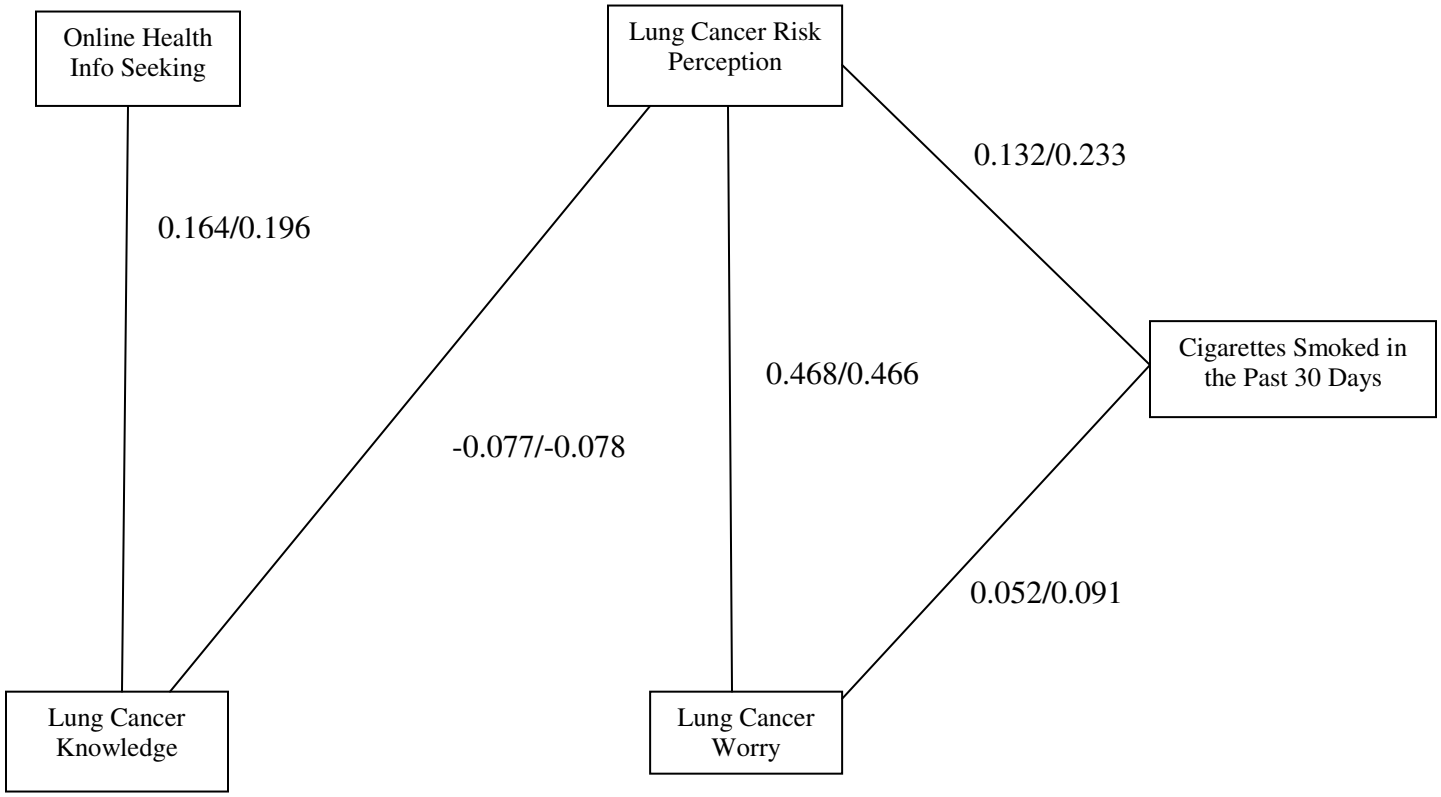
[4] The Fully Constrained Model = all model paths between males and females were restricted to be equal.

The standardized coefficients are depicted in Figure 4. Similarly, Table 2c and Table 2d depict the unstandardized and standardized path coefficients respectively. Throughout this chapter, "B" refers to the unstandardized coefficient while "β" represents the standardized value.




*Coefficients are significant at alpha < .05.

Figure 3. The Unstandardized Path Analysis Coefficients for the Final Lung Cancer Model, Controlling for Age, Race, Education and Personal/Family History of Cancer.




All Coefficients are significant at alpha < .05.
Note: First coefficient refers to males while the second refers to females.

Figure 4. The Standardized Path Analysis Coefficients for the Final Lung Cancer Model, Controlling for Age, Race, Education and Personal/Family History of Cancer.

Table 2c. Unstandardized Path Analysis Coefficients and Their Standard Errors for the Lung Cancer Model Comparing the Male vs. the Female Sub-Samples ($n_{males}$ = 860; $n_{females}$ = 1,012)[1,2,3,4]

| | | Predicted Variables | | | | |
|---|---|---|---|---|---|---|
| | | Lung Cancer Knowledge | Online Health Info Seeking | Lung Cancer Risk Perception | Lung Cancer Worry | Cigarettes Smoked in the Past 30 Days |
| Control Variables | Age | | -0.034* | -0.004* | -0.003* | |
| | | | (0.004) | (0.002) | (0.001) | |
| | Race (Caucasian) | 0.792* | 0.330* | | | |
| | | (0.175) | (0.143) | | | |
| | Education | 0.391* | 0.557* | | -0.093* | |
| | | (0.048) | (0.041) | | (0.017) | |
| | Cancer History (Pers./Fam.) | 0.388* | 0.239* | 0.232* | 0.152* | |
| | | (0.145) | (0.128) | (0.082) | (0.044) | |
| Predictor Variables | Lung Cancer Knowledge | - | | -0.044* | | |
| | | | | (0.024) | | |
| | Online Health Info Seeking | 0.196* | - | | | |
| | | (0.032) | | | | |
| | Lung Cancer Risk Perception | | | - | | 4.120* |
| | | | | | | (0.722) |
| | Lung Cancer Worry | | | 0.815* | - | 2.810* |
| | | | | (0.071) | | (1.347) |

*Coefficients are significant at alpha = 0.05.

[1]Blank cell indicates that the particular path coefficient was not tested or was removed from the final model.

[2]The presence of a single coefficient in the cell indicates that the same coefficient holds for both the male and female sub-sample.

[3]The presence of two coefficients separated by a forward slash indicates different coefficients for the male versus the female sub-sample. The first coefficient is representative for males and the second coefficient is representative for females.

[4]The highlighted rows represent the unstandardized model path coefficients while the ones below (the ones that are not highlighted) represent the standard errors for the respective unstandardized path coefficients.

Table 2d. Standardized Path Analysis Coefficients and Their Standard Errors for the Lung Cancer Model for the Male and the Female Sub-Samples ($n_{males}$= 860; $n_{females}$= 1,012)[1,2]

| | | Predicted Variables | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lung Cancer Knowledge | | Online Health Info Seeking | | Lung Cancer Risk Perception | | Lung Cancer Worry | | Cigarettes Smoked in the Past 30 Days | |
| | | Males | Females | Males | Females | Males | Females | Males | Females | Males | Females |
| Control Variables | Age | | | -0.314 | -0.293 | -0.060 | -0.068 | -0.064 | -0.073 | | |
| | | | | (0.033) | (0.033) | (0.029) | (0.033) | (0.026) | (0.030) | | |
| | Race (Caucasian) | 0.171 | 0.172 | 0.085 | 0.072 | | | | | | |
| | | (0.036) | (0.037) | (0.037) | (0.031) | | | | | | |
| | Education | 0.233 | 0.223 | 0.397 | 0.318 | | | -0.171 | -0.166 | | |
| | | (0.031) | (0.028) | (0.034) | (0.023) | | | (0.028) | (0.027) | | |
| | Cancer History (Pers./Fam.) | 0.084 | 0.078 | 0.062 | 0.048 | 0.089 | 0.084 | 0.101 | 0.096 | | |
| | | (0.031) | (0.029) | (0.033) | (0.026) | (0.031) | (0.030) | (0.028) | (0.028) | | |
| Predictor Variables | Lung Cancer Knowledge | - | - | | | -0.077 | -0.078 | | | | |
| | | | | | | (0.042) | (0.042) | | | | |
| | Online Health Info Seeking | 0.164 | 0.196 | - | - | | | | | | |
| | | (0.026) | (0.031) | | | | | | | | |
| | Lung Cancer Risk Perception | | | | | - | - | | | 0.132 | 0.233 |
| | | | | | | | | | | (0.045) | (0.038) |
| | Lung Cancer Worry | | | | | 0.468 | 0.466 | - | - | 0.052 | 0.091 |
| | | | | | | (0.045) | (0.039) | | | (0.027) | (0.044) |
| | $R^2$ | 0.202 | 0.179 | 0.255 | 0.228 | 0.247 | 0.244 | 0.039 | 0.038 | 0.027 | 0.083 |

Note: All standardized coefficients are significant at alpha = 0.05.

[1]Blank cell indicates that the particular path coefficient was not tested or was removed from the final model.

[2]The highlighted rows represent the standardized model path coefficients while the ones below (the ones that are not highlighted) represent the standard errors for the respective standardized path coefficients.

Hypothesis H1a proposed that online health information seeking behavior was positively related to lung cancer knowledge. The findings indicate that H1a is fully supported. Controlling for age, race education and personal or family histories of cancer, one unit increase in the online health information index yields a 0.196 (SE = 0.032, $p < 0.001$) increase in the cancer knowledge index among both sub-samples.

In addition to the proposed relationship, the results indicate that control variables, race, education and history of family or personal cancer represent significant predictors of lung cancer knowledge as well. Education is positively related to lung cancer knowledge. Caucasians and individuals with personal or family histories of cancer report higher scores on the lung cancer knowledge index. In terms of the magnitude of the coefficients, the standardized solution places education at the top with the highest value ($\beta_{males} = 0.233$, $p = 0.001$; $\beta_{females} = 0.223$, $p < 0.001$) followed by race ($\beta_{males} = 0.171$, $p < 0.001$; $\beta_{females} = 0.172$, $p < 0.001$) and online health information seeking ($\beta_{males} = 0.164$, $p < 0.001$; $\beta_{females} = 0.196$, $p < 0.001$). A history of personal or family cancer has only a limited influence on knowledge. These predictors account for roughly 20.2 percent of the variance in lung cancer knowledge among males and 17.9 percent among females.

Even though this study does not propose any hypotheses involving online health information seeking, the results indicate several significant relationships between the control variables and online health information seeking behavior. The findings suggest that online health information seeking has a negative relationship with age and a positive relationship with education. Caucasians and individuals with personal or family histories of cancer report higher scores on the online health information seeking index. Education ($\beta_{males} = 0.397$, $p < 0.001$; $\beta_{females} = 0.318$, $p < 0.001$) and age ($\beta_{males} = -0.314$, $p < 0.001$; $\beta_{females} = -0.293$, $p < 0.001$) seem to have the highest relative importance among predictors. Race and personal or family histories of cancer yield smaller coefficients. The control variables explain approximately 25.5 percent of the variance in online health information seeking among males and 22.8 percent among females.

The next set of hypotheses highlight lung cancer risk perceptions as the outcome. They proposed that risk perceptions were negatively related to lung cancer knowledge and online information seeking among males (H1b) and the opposite among females (H1c). In addition, they also proposed that risk perceptions were positively associated with worry among both sub-samples. These hypotheses are only partially supported. Consistent with H1b, lung cancer risk perceptions are negatively related to lung cancer knowledge among males (B = -0.044, SE = 0.024, $p = 0.033$); additionally, the outcome is

positively related to lung cancer worry among both males and females (B = 0.815, SE = 0.071, $p < .001$). In contrast with H1c, lung cancer risk perceptions are negatively related to lung cancer knowledge among females.

Risk perceptions are also significantly related to two of the control variables. Results indicate that higher age yields lower risk perceptions while history of personal or family cancer yields higher risk perceptions. Examining the magnitude of the coefficients, lung cancer worry registers the highest standardized value for both sub-samples ($\beta_{males} = 0.468$, $p < 0.001$; $\beta_{females} = 0.466$, $p < 0.001$). The total variance accounted for in lung cancer risk perceptions by the variables is 24.7 percent among males and 24.4 percent among females.

Hypothesis H1d and H1e referred to the relationships between worry and lung cancer knowledge and online health information seeking. These propositions proposed a negative relationship between worry and online health information seeking and lung cancer knowledge among males (H1d) and a positive one among females (H1e). Neither of the two hypotheses is supported. Only the control variables are significant predictors of lung cancer worry. Age and education are negatively related to worry about developing lung cancer. Also, personal or family histories of cancer yield higher level of lung cancer worry. In terms of relative importance, the highest standardized coefficients are encountered among the control variables, education and history of personal or family cancer. The variance in worry explained by the predictors is low for both sub-samples ($R^2_{males} = 0.039$, $R^2_{females} = 0.038$).

Lastly, hypothesis H1f proposed that the amount of cigarettes smoked in the past 30 days was positively related to lung cancer knowledge, online health information seeking, lung cancer risk perceptions and lung cancer worry. This hypothesis is only partially supported. The amount of cigarettes smoked is positively related to risk perceptions (B = 4.120, SE = 0.722, $p < .001$) and worry (B = 2.180, SE = 1.347, $p < .017$) solely. Risk perceptions ($\beta_{males} = 0.132$, $p < 0.001$; $\beta_{females} = 0.233$, $p < 0.001$) seem to have a higher relative importance compared to worry ($\beta_{males} = 0.052$, $p < 0.017$; $\beta_{females} = 0.091$, $p < 0.017$). Risk perceptions and worry accounted for a very small portion of the variance in the outcome; three percent among males and eight percent among females.

The unstandardized results indicate that the coefficients are equal between males and females on all model paths. Consequently, it can be concluded that, among lung cancer respondents, there are no gender differences between the proposed paths.

## Colon Cancer Results

### Descriptive Analysis

The demographic characteristics as well as personal or family histories of cancer, colon cancer knowledge level, online health information seeking habits, colon cancer risk perceptions, worry about colon cancer and amount of weekly exercise (in minutes) are highlighted in Table 3a. This sample of respondents is very similar with the lung cancer sample with regards to all variables.

The sample mean age is 45.66 (SD = 17.94), with a slightly higher mean among females (M = 46.64, SD = 18.26) compared to males (M = 44.61, SD = 17.55). Approximately three quarters of the male (71.2%) and female (70.7%) sub-samples are Caucasian. In contrast from the previous sample, "some college courses" is representative for the largest percentage of female respondents (31.2%) while a high school degree is representative for the largest percentage of males (31.4%). Roughly three quarters of the sub-samples have personal or family histories of cancer (72.2% - males; 76.0% - females).

Females, compared to males, report a higher mean score for the colon cancer knowledge and the online health information seeking indices. A third of respondents in each of the sub-samples report very low risk perceptions about developing colon cancer (35.9% - males; 41.6% - females). The majority of males and females report rare or absent colon cancer worries (78.7% and 79.6% respectively). Males, on average, exercise more minutes per week (M = 563.4, SD = 804.4) than females (M = 245.5, SD = 396.3).

Table 3a. Weighted Descriptive Statistics for the Colon Cancer Sample Respondents: Demographics, Cancer History, Risk Perception, Cancer Worry, Knowledge Index, Online Health Information Seeking Behavior, Weekly Exercise

| | | Total Sample | Male Sample | Female Sample |
|---|---|---|---|---|
| | | n = 1,978 | n = 949 | n = 1,029 |
| **Control Variables** | | | | |
| Age | | | | |
| | Mean | 45.66 | 44.61 | 46.64 |
| | Std. Deviation | 17.94 | 17.55 | 18.26 |
| | Median | 44.00 | 43.00 | 45.00 |
| | Mode | 19.00 | 36.00 | 20.00 |
| | Minimum | 18.00 | 18.00 | 18.00 |
| | Maximum | 94.00 | 93.00 | 94.00 |
| Race | | | | |
| | Other | 29.10% | 28.80% | 29.29% |
| | Caucasian | 70.90% | 71.20% | 70.71% |
| Education | | | | |
| | Never Attended School | 0.40% | 0.78% | 0.04% |
| | Middle School or Less | 5.40% | 4.50% | 6.24% |
| | Some High School | 9.55% | 8.97% | 10.09% |
| | High School Graduate | 31.48% | 28.32% | 34.39% |
| | Some College | 29.08% | 31.24% | 27.09% |
| | College Graduate | 14.95% | 15.78% | 14.19% |
| | Post-Graduate Degree | 9.14% | 10.42% | 7.96% |
| Cancer History (Pers./Fam.) | | | | |
| | No | 25.83% | 27.82% | 24.00% |
| | Yes | 74.17% | 72.18% | 76.00% |
| **Predictor/Predicted Variables** | | | | |
| Colon Cancer Knowledge Index | | | | |
| | Mean | 3.02 | 2.80 | 3.22 |
| | Std. Deviation | 1.97 | 1.89 | 2.02 |
| | Median | 3.00 | 3.00 | 3.00 |
| | Mode | 1.00 | 3.00 | 1.00 |
| | Minimum | 0.00 | 0.00 | 0.00 |
| | Maximum | 9.00 | 8.00 | 9.00 |

Table 3a cont. Weighted Descriptive Statistics for the Colon Cancer Sample Respondents: Demographics, Cancer History, Risk Perception, Cancer Worry, Knowledge Index, Online Health Information Seeking Behavior, Weekly Exercise

| | | Total Sample | Male Sample | Female Sample |
|---|---|---|---|---|
| | | n = 1,978 | n = 949 | n = 1,029 |
| **Predictor/Predicted Variables** | | | | |
| Online Health Info Seeking Behavior | | | | |
| | Mean | 1.77 | 1.66 | 1.88 |
| | Std. Deviation | 1.96 | 1.88 | 2.03 |
| | Median | 1.00 | 1.00 | 1.00 |
| | Mode | 0.00 | 0.00 | 0.00 |
| | Minimum | 0.00 | 0.00 | 0.00 |
| | Maximum | 5.00 | 5.00 | 5.00 |
| Colon Cancer Risk Perception | | | | |
| | Very low | 38.90% | 35.93% | 41.60% |
| | Somewhat low | 28.36% | 25.81% | 30.68% |
| | Moderate | 26.43% | 30.28% | 22.92% |
| | Somewhat high | 5.07% | 6.21% | 4.04% |
| | Very high | 1.24% | 1.78% | 0.75% |
| Colon Cancer Worry | | | | |
| | Rarely or never | 79.21% | 78.74% | 79.64% |
| | Sometimes | 16.94% | 16.68% | 17.18% |
| | Often | 1.98% | 2.58% | 1.42% |
| | All the time | 1.87% | 2.00% | 1.76% |
| Minutes of Exercise per Week | | | | |
| | Mean | 397.75 | 563.41 | 245.48 |
| | Std. Deviation | 645.56 | 804.38 | 396.30 |
| | Median | 180.00 | 240.00 | 135.00 |
| | Mode | 0.00 | 0.00 | 0.00 |
| | Minimum | 0.00 | 0.00 | 0.00 |
| | Maximum | 3,600.00 | 3,600.00 | 3,600.00 |

**Path Analysis**

The path analysis process for the colon cancer sample involved the same procedure as the lung cancer one. The technique included developing an initial model, adjusting it based on the modification indices, generating a new model and reestimating it to achieve a final model. Table 3b highlights the Satorra-Bentler chi-square difference test coefficients which statistically compare the unconstrained, the fully constrained and the final models. The Satorra-Bentler chi-square results show that the final model fits the data statistically better compared to the previous two models. Additional partially constrained models were developed and compared with the final model. All of these subsequent models were not statistically better than the final model. The final model included two unequal paths between males and females.

Table 3b includes the five fit indices used to evaluate the fit of the unconstrained, the fully constrained and the final models as well. Figure 5 and Figure 6 show the final model with the unstandardized and standardized path coefficients respectively. In addition, Table 3c and Table 3d depict the unstandardized and standardized path coefficients with their associated standard errors and the variance accounted for by the predictors.

The five fit indices of the final model indicate a close fit: $X^2_{37} = 52.722$ (p = .045); CFI = 0.981; TLI = 0.970; RMSEA = 0.021; SRMR = 0.028. The two unequal paths between males and females include the relationships between age and online health information seeking and age and exercise.

Table 3b. The Fit Indices[1] and the Satorra-Bentler $X^2$ Difference Test Coefficients[2] for the Colon Cancer Nested Models

| Model | $X^2$*(df, p-value)* | CFI | TLI | RMSEA | SRMR | Satorra-Bentler $X^2$ Difference Test Coefficient (df, p-value) |
|---|---|---|---|---|---|---|
| The Unconstrained Model[3] | 26.4 (18, 0.09) | 0.990 | 0.967 | 0.022 | 0.018 | |
| The Fully Constrained Model[4] | 64.265 (39, 0.006) | 0.970 | 0.954 | 0.026 | 0.031 | |
| The Unconstrained Model vs. the Fully Constrained Model | | | | | | 18.960 (21, > .05) |
| The Final Model (Partially Constrained)[5] | 52.722 (37, 0.045) | 0.981 | 0.970 | 0.021 | 0.028 | |
| The Fully Constrained vs. the Final Model | | | | | | ***6.04 (2, < .05)*** |

Additional partially constrained models were developed and compared with the final model. The Satorra-Bentler $X^2$ difference test yielded non-significant chi-squares indicating that the final model fits the data the best.

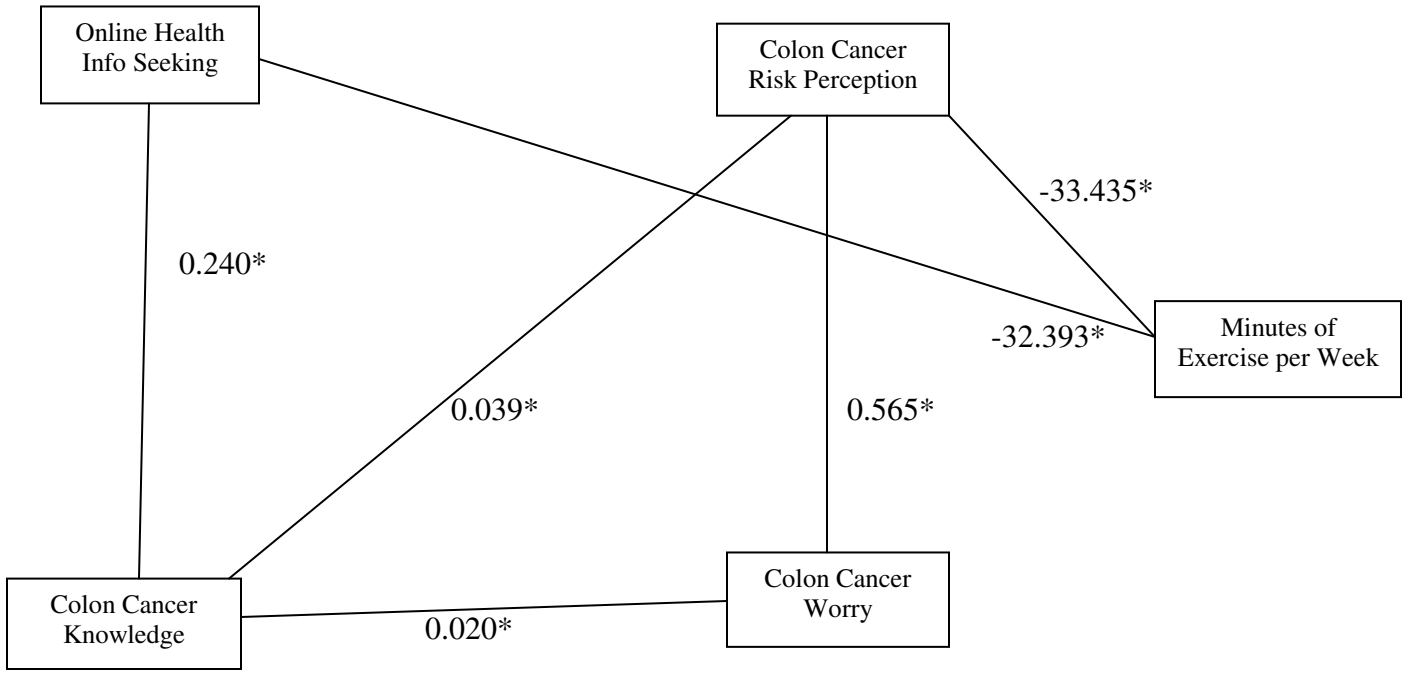
[1]Interpretation Criteria for the Goodness of Fit Indices: non-significant $X^2$, CFI and TLI coefficients greater than 0.90 and RMSEA and SRMR coefficients lower than 0.05 indicate good model fit.

[2]Interpretation Criteria for the Satorra-Bentler $X^2$difference test: significant $X^2$ difference test indicates that the more complex model (with freely estimated paths between males and females) fits the data better than the simpler model (with equal paths between males and females) and that the more complex model should be kept. Non-significant $X^2$ difference test indicates that the simpler model should be retained.

[3]The Unconstrained Model = all model paths between males and females were allowed to vary.

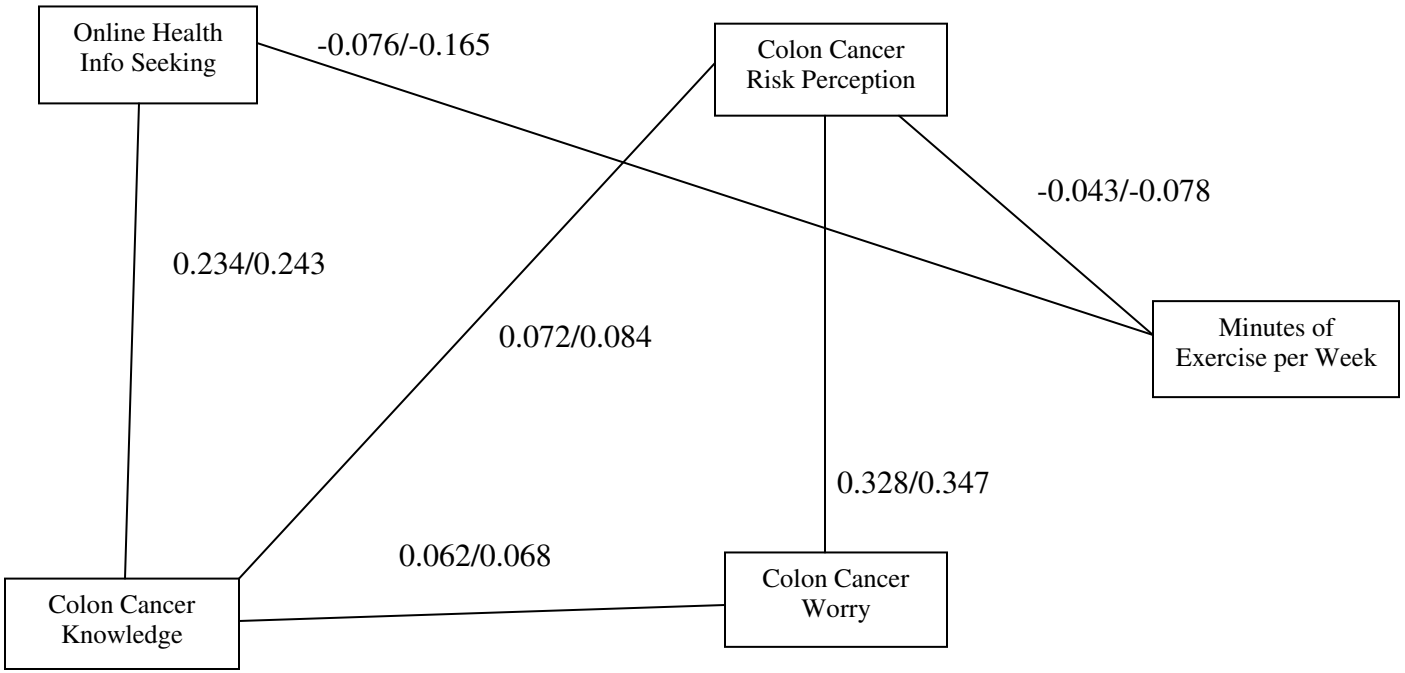
[4]The Fully Constrained Model = all model paths between males and females were restricted to be equal.

[5]Final (Partially Constrained) Model = based on the modification indices, certain model paths between males and females were allowed to vary.




*Coefficients significant at alpha < .05

Figure 5. The Unstandardized Path Analysis Coefficient for the Final Colon Cancer Model, Controlling for Age, Race, Education and Personal/Family History of Cancer.




All Coefficients significant at alpha < .05
Note: First coefficient refers to males, while the second refers to females.

Figure 6. The Standardized Path Analysis Coefficient for the Final Colon Cancer Model, Controlling for Age, Race, Education and Personal/Family History of Cancer.

Table 3c. Unstandardized Path Analysis Coefficients and Their Standard Errors for the Colon Cancer Model Comparing the Male vs. the Female Sub-Samples ($n_{males}$ = 949; $n_{females}$ = 1,025)[1,2,3,4]

| | | Predicted Variables | | | | |
|---|---|---|---|---|---|---|
| | | Colon Cancer Knowledge | Online Health Info Seeking | Colon Cancer Risk Perception | Colon Cancer Worry | Minutes of Weekly Exercise |
| Control Variables | Age | 0.022* | -0.027*/-0.040* | -0.005* | | -8.407*/-2.100* |
| | | (0.003) | (0.005/0.004) | (0.002) | | (3.185/0.885) |
| | Race (Caucasian) | 0.722* | 0.504* | 0.158* | -0.175* | |
| | | (0.126) | (0.133) | (0.080) | (0.052) | |
| | Education | 0.398* | 0.544* | | -0.071* | |
| | | (0.043) | (0.038) | | (0.016) | |
| | Cancer History (Pers./Fam.) | | 0.225* | 0.166* | 0.046(NS) | 53.670* |
| | | | (0.129) | (0.070) | (0.042) | (29.715) |
| Predictor Variables | Colon Cancer Knowledge | - | | 0.039* | 0.020* | |
| | | | | (0.015) | (0.010) | |
| | Online Health Info Seeking | 0.240* | - | | | -32.393* |
| | | (0.030) | | | | (6.444) |
| | Colon Cancer Risk Perception | | | - | | -33.435* |
| | | | | | | (14.953) |
| | Colon Cancer Worry | | | 0.565* | - | |
| | | | | (0.073) | | |

*Coefficients are significant at alpha = 0.05.
NS indicates non-significant coefficients.

[1]Blank cell indicates that the particular path coefficient was not tested or was removed from the final model.

[2]The presence of a single coefficient in the cell indicates that the same coefficient holds for both the male and female sub-samples.

[3]The presence of two coefficients separated by forward slash indicates different coefficients for the male versus the female sub-sample. The first coefficient is representative for males and the second coefficient is representative for females.

[4]The highlighted rows represent the unstandardized model path coefficients while the ones below (that are not highlighted) represent the standard errors for the respective path coefficients.

Table 3d. Standardized Path Analysis Coefficients and Their Standard Errors for the Colon Cancer Model Comparing the Male versus the Female Sub-Samples ($n_{males}$ = 949; $n_{females}$ = 1,025)[1,2]

| | | Predicted Variables | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Colon Cancer Knowledge | | Health Info Seeking | | Colon Cancer Risk Perception | | Colon Cancer Worry | | Minutes of Weekly Exercise | |
| | | Males | Females | Males | Females | Males | Females | Males | Females | Males | Females |
| Control Variables | Age | 0.198 | 0.196 | -0.251 | -0.360 | -0.086 | -0.099 | | | -0.185 | -0.096 |
| | | (0.027) | (0.027) | (0.041) | (0.031) | (0.030) | (0.035) | | | (0.061) | (0.041) |
| | Race (Caucasian) | 0.171 | 0.164 | 0.122 | 0.113 | 0.069 | 0.077 | -0.132 | -0.139 | | |
| | | (0.030) | (0.029) | (0.032) | (0.030) | (0.035) | (0.039) | (0.036) | (0.038) | | |
| | Education | 0.270 | 0.250 | 0.378 | 0.338 | | | -0.154 | -0.157 | | |
| | | (0.030) | (0.027) | (0.029) | (0.026) | | | (0.033) | (0.034) | | |
| | Cancer History (Pers./Fam.) | | | 0.054 | 0.047 | 0.072 | 0.076 | 0.034(NS) | 0.034(NS) | 0.030 | 0.058 |
| | | | | (0.031) | (0.027) | (0.031) | (0.032) | (0.031) | (0.031) | (0.016) | (0.032) |
| Predictor Variables | Colon Cancer Knowledge | - | - | | | 0.072 | 0.084 | 0.062 | 0.068 | | |
| | | | | | | (0.028) | (0.033) | (0.032) | (0.034) | | |
| | Health Info Seeking | 0.234 | 0.243 | - | - | | | | | -0.076 | -0.165 |
| | | (0.030) | (0.030) | | | | | | | (0.016) | (0.028) |
| | Colon Cancer Risk Perception | | | | | - | - | | | -0.043 | -0.078 |
| | | | | | | | | | | (0.019) | (0.034) |
| | Colon Cancer Worry | | | | | 0.328 | 0.347 | - | - | | |
| | | | | | | (0.034) | (0.046) | | | | |
| | $R^2$ | 0.282 | 0.226 | 0.251 | 0.284 | 0.123 | 0.141 | 0.041 | 0.043 | 0.034 | 0.032 |

NS indicates non-significant coefficients; all other standardized coefficients are significant at alpha = 0.05.

[1]Blank cell indicates that the particular path coefficient was not tested or was removed from the final model.

[2]The highlighted rows represent the standardized model path coefficients while the ones below (the ones that are not highlighted) represent the standard errors for the respective path coefficients.

Hypothesis H2a stated that colon cancer knowledge was positively related to online health information seeking behaviors. Similarly to lung cancer results, H2a is fully supported among colon cancer respondents. Controlling for age, race, education and personal or family histories of cancer, one unit increase in online health information seeking index yields 0.240 (SE = 0.030, $p < 0.001$) unit increase in the colon cancer index among both sub-samples.

In addition, several control variables are significantly related to colon cancer knowledge. More specifically, colon cancer knowledge is positively related to age and education. Caucasians, compared to individuals from other ethnicities, indicated higher scores on the colon cancer knowledge index as well. In terms of the magnitude of predictor and control variables, the standardized solution highlights education ($\beta_{males} = 0.270$, $p < 0.001$; $\beta_{females} = 0.250$, $p < 0.001$) followed by online health information seeking ($\beta_{males} = 0.234$, $p < 0.001$; $\beta_{females} = 0.243$, $p < 0.001$), age ($\beta_{males} = 0.198$, $p < 0.001$; $\beta_{females} = 0.196$, $p < 0.001$) and race ($\beta_{males} = 0.171$, $p < 0.001$; $\beta_{females} = 0.164$, $p < 0.001$). The predictor and control variables account for approximately a fourth of the variance in colon cancer knowledge among both males and females ($R^2_{males} = 0.282$; $R^2_{females} = 0.226$).

Similarly to the lung cancer model, there are no hypotheses involving online health information seeking behavior for the colon cancer model. However, the control variables are significantly related to online health information seeking. Lower age ($B_{males} = -0.027$, SE = 0.005 $p < 0.001$; $B_{females} = -0.040$, SE = 0.004, $p < 0.001$) and higher education (B = 0.544, 0.038, $p < 0.001$) yield higher score on the online health information index. In addition, Caucasians (B = 0.504, SE = 0.133, $p < 0.001$) and individuals with history of personal or family cancer (B = 0.225, SE = 0.129, $p = 0.04$) report higher score on the online health information index compared to their counterparts.

The standardized solution depicts the relative importance of the control variables in relation to online health information seeking. Thus, in terms of magnitude, the results emphasize education ($\beta_{males} = 0.378$, $p < 0.001$; $\beta_{females} = 0.338$, $p < 0.001$) and age ($\beta_{males} = -0.251$, $p < 0.001$; $\beta_{females} = -0.360$, $p < 0.001$), followed by race ($\beta_{males} = 0.122$, $p < 0.001$; $\beta_{females} = 0.113$, $p < 0.001$). Personal or family histories of cancer have the smallest standardized coefficients among variables. The control variables explain 25.1 percent of the variance in the outcome among males and 28.4 percent among females.

The next set of hypotheses proposed that colon cancer risk perceptions are negatively related to colon cancer knowledge and online health information seeking among males (H2b) and positively related among females (H2c). These hypotheses also suggested a positive relationship between colon cancer risk perceptions and colon cancer worry among both sub-samples. H2b and H2c are partly

supported. Consistent with the hypothesized directions, risk perceptions are positively related to colon cancer knowledge among females (B = 0.039, SE = 0.015, p = .005) and to colon cancer worry among both sub-samples (B = 0.565, SE = 0.073, p < 0.001). However, in contrast to the proposed direction of H2b, the results indicate a positive relationship between risk perceptions and colon cancer knowledge among males as well.

In addition, the control variables, age, race and history of personal or family cancer are significantly related to colon cancer risk perceptions. More specifically, there is a negative relationship between age and colon cancer risk perceptions. Caucasians and individuals with personal or family histories of cancer report higher risk perceptions compared to their counterparts. In terms of the magnitude of the coefficients, colon cancer worry has the highest standardized coefficient among the predictors ($\beta_{males} = 0.328$, $p < 0.001$, $\beta_{females} = 0.347$, $p < 0.001$). All these variables account for 12.3 percent of the variance in colon cancer risk perceptions among males and 14.1 percent among females.

Hypotheses H2d and H2e dealt with the predictors of colon cancer worry. These hypotheses suggested that colon cancer worry was negatively related to colon cancer knowledge and online health information seeking among males (H2d) and the opposite among females (H2e). The results show a positive relationship between worry and knowledge among both females and males (B = 0.020, SE = 0.010, p = .023) and no support for the relationship between worry and online health information seeking. Thus, only H2e is partially supported.

Two of the control variables are significantly related to colon cancer worry as well. The findings indicate a negative relationship between education and colon cancer worry. Caucasians, compared to individuals of other ethnicities, worry less about colon cancer. In terms of the magnitude of the predictors, the standardized results depict small coefficients for all three variables. Among males and females, roughly four percent of the variance in colon cancer worry is accounted for by the predictors ($R^2_{males} = 0.041$, $R^2_{females} = 0.043$).

Lastly, hypothesis H2f proposed that the amount of exercise per week is positively related to colon cancer knowledge and online health information seeking and negatively related to colon cancer risk perceptions and worry. This hypothesis is only partially supported in that the amount of exercise is negatively related to risk perceptions (B = -33.435, SE = 14.953, p = .013). In contrast from the proposed direction, the results suggest a negative relationship between the amount of exercise and online health information seeking (B = -32.393, SE = 6.444, p < .001).

The control variables, age and history of personal or family cancer, have a significant relationship with the amount of exercise per week as well. Higher age yields fewer minutes per week spent exercising whereas, personal or family histories of cancer yield higher amounts of exercise. Comparing the magnitude of the predictors, age has the highest standardized coefficient value ($\beta_{males}$ = -0.185, p = 0.002, $\beta_{females}$ = -0.096, p = 0.018). A very small portion of the variance in weekly exercise is accounted for by the predictors among both sub-samples ($R^2_{males}$ = 0.034; $R^2_{females}$ = 0.032).

The unstandardized results depict two unequal paths between males and females. Nevertheless, these paths were found among the control variables and not among the proposed predictors. Based on the colon cancer model and considering the purpose of the study, it can be concluded that there are no gender differences among the proposed paths.

## Skin Cancer Results

### Descriptive Analysis

The last set of demographic characteristics is presented in Table 4a. In addition, the remaining of the variables (cancer knowledge, online health information seeking, skin cancer risk perceptions, skin cancer worry and frequency of sunscreen applications) are also highlighted in this table.

Similar patterns occur between the lung and colon cancer respondents and the skin cancer participants. Specifically, females tend to have a slightly higher mean age (M = 45.3, SD = 17.85) compared to males (M = 43.37, SD = 17.03). Two thirds of the sub-samples are Caucasian (69.2% - males; 66.9% - females). A high school degree represents the education category with the largest percentage of respondents in both sub-samples (36.9% of males and 34.5% of females). Three quarters of respondents in each sub-sample have personal or family histories of cancer (75.9% - males; 76.3% - females).

Table 4a. Weighted Descriptive Statistics for the Skin Cancer Sample Respondents: Demographics, Cancer History, Risk Perception, Cancer Worry, Knowledge Index, Online Health Information Seeking Behavior and Sunscreen Usage

| | | Total Sample | Male Sample | Female Sample |
|---|---|---|---|---|
| | | n = 1,736 | n = 874 | n = 862 |
| **Control Variables** | | | | |
| Age | | | | |
| | Mean | 44.33 | 43.37 | 45.30 |
| | Std. Deviation | 17.46 | 17.03 | 17.85 |
| | Median | 42.00 | 41.00 | 43.00 |
| | Mode | 18.00 | 18.00 | 18.00 |
| | Minimum | 18.00 | 18.00 | 18.00 |
| | Maximum | 96.00 | 91.00 | 96.00 |
| Race | | | | |
| | Other | 32.00% | 30.80% | 33.10% |
| | Caucasian | 68.00% | 69.20% | 66.90% |
| Education | | | | |
| | Never Attended School | 0.15% | 0.06% | 0.25% |
| | Middle School or Less | 5.18% | 4.95% | 5.40% |
| | Some High School | 10.09% | 9.69% | 10.49% |
| | High School Graduate | 35.66% | 36.84% | 34.47% |
| | Some College | 26.99% | 26.80% | 27.18% |
| | College Graduate | 13.15% | 12.42% | 13.88% |
| | Post-Graduate Degree | 8.79% | 9.24% | 8.33% |
| Cancer History (Pers./Fam.) | | | | |
| | No | 23.90% | 24.10% | 23.70% |
| | Yes | 76.10% | 75.90% | 76.30% |
| **Predictor/Predicted Variables** | | | | |
| Skin Cancer Knowledge | | | | |
| | Mean | 6.65 | 6.50 | 6.81 |
| | Std. Deviation | 2.54 | 2.62 | 2.46 |
| | Median | 7.00 | 7.00 | 7.00 |
| | Mode | 7.00 | 7.00 | 7.00 |
| | Minimum | 0.00 | 0.00 | 0.00 |
| | Maximum | 11.00 | 11.00 | 11.00 |

Table 4a cont. Weighted Descriptive Statistics for the Skin Cancer Sample Respondents: Demographics, Cancer History, Risk Perception, Cancer Worry, Knowledge Index, Online Health Information Seeking Behavior and Sunscreen Usage

| | | Total Sample | Male Sample | Female Sample |
|---|---|---|---|---|
| | | n = 1736 | n = 874 | n = 862 |
| **Predictor/Predicted Variables** | | | | |
| Online Health Info Seeking Behavior | | | | |
| | Mean | 1.59 | 1.39 | 1.79 |
| | Std. Deviation | 1.90 | 1.80 | 1.98 |
| | Median | 0.00 | 0.00 | 1.00 |
| | Mode | 0.00 | 0.00 | 0.00 |
| | Minimum | 0.00 | 0.00 | 0.00 |
| | Maximum | 5.00 | 5.00 | 5.00 |
| Skin Cancer Risk Perception | | | | |
| | Very low | 26.34% | 27.18% | 25.53% |
| | Somewhat low | 25.97% | 25.55% | 26.39% |
| | Moderate | 34.71% | 33.60% | 35.79% |
| | Somewhat high | 8.56% | 8.51% | 8.62% |
| | Very high | 4.41% | 5.16% | 3.68% |
| Skin Cancer Worry | | | | |
| | Rarely or never | 65.59% | 69.64% | 61.61% |
| | Sometimes | 27.38% | 24.85% | 29.88% |
| | Often | 4.57% | 3.76% | 5.37% |
| | All the time | 2.45% | 1.75% | 3.15% |
| Sunscreen Usage | | | | |
| | Never | 33.98% | 39.96% | 27.87% |
| | Rarely | 17.25% | 19.70% | 14.74% |
| | Sometimes | 21.91% | 21.93% | 21.89% |
| | Often | 14.39% | 10.88% | 17.99% |
| | Always | 12.47% | 7.53% | 17.51% |

Females, compared to their counterparts, report higher mean score for the skin cancer knowledge and the online health information seeking indices. Unlike the previous two sets of descriptive results, the largest percentage of respondents in the two gender groups (34.7% - males and 33.6% - females) indicates moderate risk perceptions compared to very low risk perceptions in the previous samples. Two thirds of the sub-samples report rare or absent worries (69.6% - males; 61.6% - females). The largest percentage of males and females say they never use sunscreen (39.9% of males 27.9% of females).

**Path Analysis**

The same path analysis technique was employed to test the direction and significance of the proposed relationships for the skin cancer sample. The analysis included an initial evaluation of a proposed model, a model modification stage, a reevaluation of the subsequent model(s) and a chi-square difference test to determine the best, parsimonious model. Table 4b highlights the fit indices for the unconstrained, the fully constrained and the final models as well as the Satorra-Bentler chi-square different test results for the three models.

The model with three unequal paths between males and females yielded a significant chi-square difference test and good fit indices. This model became the final model. The five fit indices indicate a close fit: $X^2_{39} = 40.353$ (p = .41); CFI = 0.998; TLI = 0.997; RMSEA = 0.006; SRMR = 0.028.

Figure 7 and Figure 8 depict the unstandardized and standardized path coefficients of the final model respectively. In addition, Table 4c and Table 4d highlight the unstandardized and standardized path coefficients along with their respective standard errors and the variance explained by the predictors. The three unequal paths between males and females regard the relationships between worry and risk perceptions, online health information seeking and sunscreen usage and education and sunscreen usage.

Table 4b. The Fit Indices[1] and the Satorra-Bentler $X^2$ Difference Test Coefficients[2] for the Skin Cancer Nested Models

| Model | $X^2$*(df, p-value)* | CFI | TLI | RMSEA | SRMR | Satorra-Bentler $X^2$ Difference Test Coefficient (df, p-value) |
|---|---|---|---|---|---|---|
| The Unconstrained Model[3] | 20.467 (20, 0.43) | 0.999 | 0.998 | 0.005 | 0.016 | |
| The Fully Constrained Model[4] | 57.722 (42, 0.05) | 0.980 | 0.972 | 0.021 | 0.031 | |
| The Unconstrained Model vs. the Fully Constrained Model | | | | | | 22.268 (22, > .05) |
| The Final Model (Partially Constrained)[5] | 40.353 (39, 0.41) | 0.998 | 0.997 | 0.006 | 0.028 | |
| The Fully Constrained vs. the Final Model | | | | | | ***12.028(3, < .05)*** |

Additional partially constrained models were developed and compared with the final model but the Satorra-Bentler $X^2$ difference test yielded non-significant chi-squares indicating that the final model fits the data the best.

[1]Interpretation Criteria for the Goodness of Fit Indices: non-significant $X^2$, CFI and TLI coefficients greater than 0.90 and RMSEA and SRMR coefficients lower than 0.05 indicate good model fit.

[2] Interpretation Criteria for the Satorra-Bentler $X^2$difference test: significant $X^2$ difference test indicates that the more complex model (with freely estimated paths between males and females) fits the data better than the simpler model (with equal paths between males and females) and that the more complex model should be kept. Non-significant $X^2$ difference test indicates that the simpler model should be retained.

[3]The Unconstrained Model = all model paths between males and females were allowed to vary.

[4]The Fully Constrained Model = all model paths between males and females were restricted to be equal.

[5]The Final (Partially Constrained) Model = based on the modification indices, certain model paths between males and females were allowed to vary.

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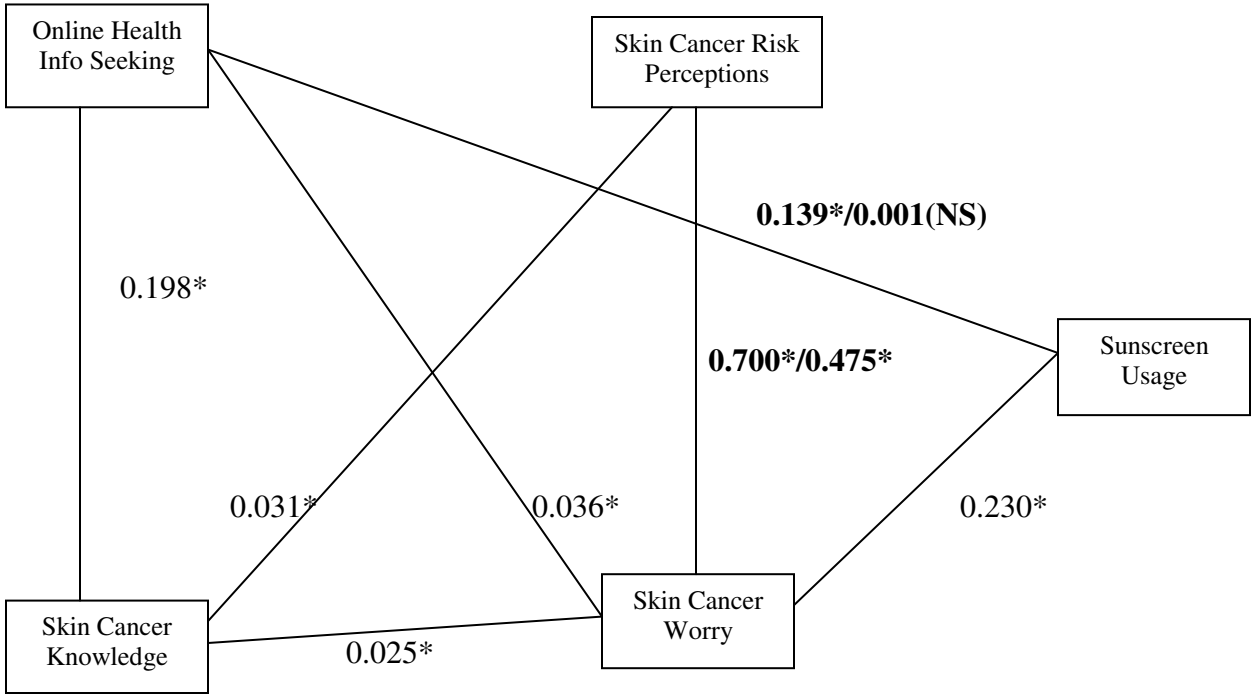
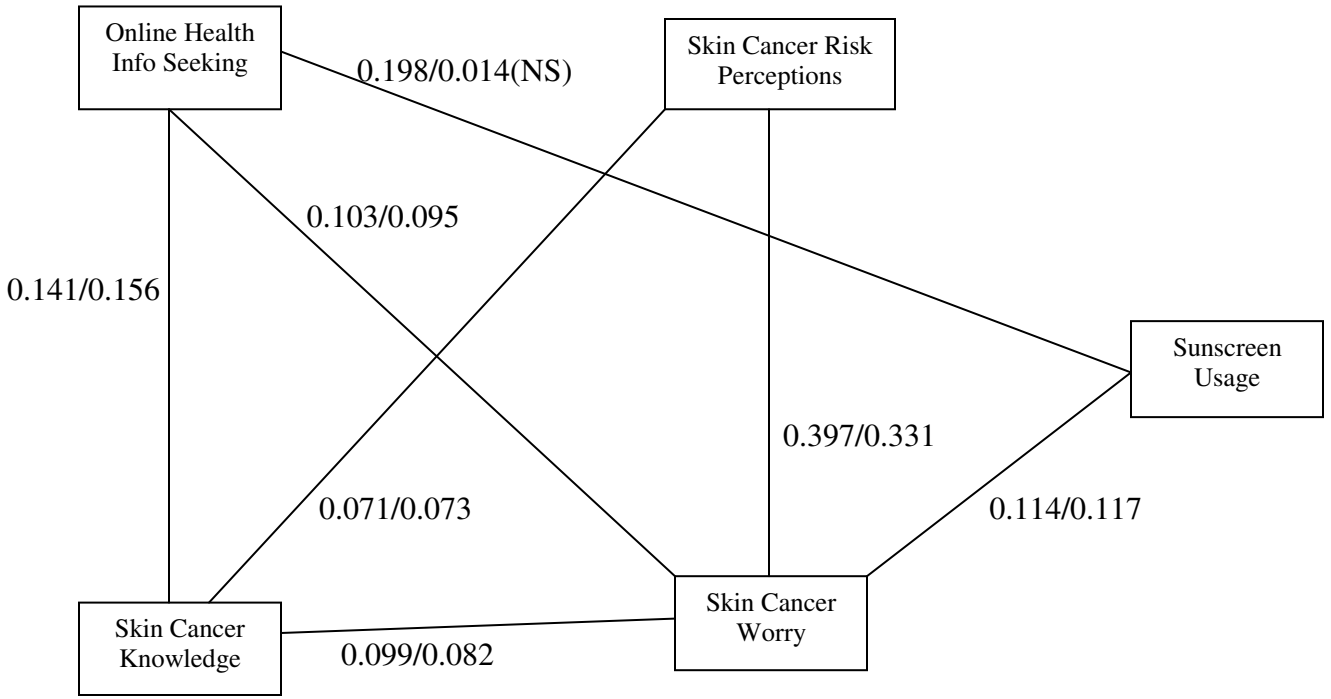



*Coefficients significant at alpha < .05
NS indicates non-significant coefficients.
Note : Among the highlighted coefficients, the first values corresponds to the male sample while the second value corresponds to the females sample.

Figure 7. The Unstandardized Path Analysis Coefficients for the Final Skin Cancer Model, Controlling for Age, Race, Education and Personal/Family History of Cancer.




All coefficients significant at alpha < .05, except where NS indicates non-significant coefficient.
Note : First coefficient refers to males, while the second refers to females.

Figure 8. The Standardized Path Analysis Coefficients for the Final Skin Cancer Model, Controlling for Age, Race, Education and Personal/Family History of Cancer.

Table 4c. Unstandardized Path Analysis Coefficients and Their Standard Errors for the Skin Cancer Model Comparing the Male vs. the Female Sub-Samples ($n_{males}$ = 874; $n_{females}$ = 862)[1,2,3,4]

| | | Predicted Variables | | | | |
|---|---|---|---|---|---|---|
| | | Skin Cancer Knowledge | Online Health Info Seeking | Skin Cancer Risk Perception | Skin Cancer Worry | Sunscreen Usage |
| Control Variables | Age | -0.009* | -0.031* | -0.009* | | |
| | | (0.004) | (0.003) | (0.002) | | |
| | Race (Caucasian) | 1.278* | 0.453* | 0.477* | | 0.561* |
| | | (0.151) | (0.137) | (0.078) | | (0.095) |
| | Education | 0.426* | 0.532* | | | 0.118*/0.335* |
| | | (0.058) | (0.038) | | | (0.055/0.038) |
| | Cancer History (Pers./Fam.) | | 0.358* | 0.138* | | |
| | | | (0.129) | (0.075) | | |
| Predictor Variables | Skin Cancer Knowledge | - | | 0.031* | 0.025* | |
| | | | | (0.017) | (0.012) | |
| | Online Health Info Seeking | 0.198* | - | | 0.036* | 0.139*/0.011(NS) |
| | | (0.042) | | | (0.012) | (0.035/0.031) |
| | Skin Cancer Risk Perception | | | - | | |
| | Skin Cancer Worry | | | 0.700*/0.475* | - | 0.230* |
| | | | | (0.087/0.055) | | (0.063) |

*Coefficients are significant at alpha = 0.05.
NS indicates non-significant coefficients.

[1]Blank cell indicates that the particular path coefficient was not tested or was removed from the final model.

[2]The presence of a single coefficient in the cell indicates that the same coefficient holds for both the male and female sub-sample.

[3]The presence of two coefficients separated by forward slash indicates different coefficients for the male versus the female sub-sample. The first coefficient is representative for males and the second coefficient is representative for females.

[4]The highlighted rows represent the unstandardized model path coefficients while the ones below (the ones that are not highlighted) represent the standard errors for the respective path coefficients.

Table 4d. Standardized Path Analysis Coefficients and Their Standard Errors for the Skin Cancer Model Comparing the Male vs. the Female Sub-Samples ($n_{males}$ = 874; $n_{females}$ = 862)[1,2]

| | | Predicted Variables in the Model | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Skin Cancer Knowledge | | Online Health Info Seeking | | Skin Cancer Risk Perception | | Skin Cancer Worry | | Sunscreen Use | |
| | | Males | Females | Males | Females | Males | Females | Males | Females | Males | Females |
| Control Variables | Age | -0.061 | -0.065 | -0.295 | -0.285 | -0.135 | -0.148 | | | | |
| | | (0.030) | (0.032) | (0.028) | (0.029) | (0.030) | (0.034) | | | | |
| | Race (Caucasian) | 0.230 | 0.247 | 0.115 | 0.111 | 0.196 | 0.214 | | | 0.202 | 0.184 |
| | | (0.028) | (0.030) | (0.035) | (0.034) | (0.033) | (0.035) | | | (0.034) | (0.032) |
| | Education | 0.204 | 0.220 | 0.359 | 0.349 | | | | | 0.113 | 0.294 |
| | | (0.028) | (0.030) | (0.029) | (0.026) | | | | | (0.053) | (0.033) |
| | Cancer History (Pers./Fam.) | | | 0.083 | 0.078 | 0.052 | 0.055 | | | | |
| | | | | (0.030) | (0.028) | (0.028) | (0.030) | | | | |
| Predictor Variables | Skin Cancer Knowledge | - | - | | | 0.071 | 0.073 | 0.099 | 0.082 | | |
| | | | | | | (0.040) | (0.039) | (0.048) | (0.040) | | |
| | Online Health Info Seeking | 0.141 | 0.156 | - | - | | | 0.103 | 0.095 | 0.198 | 0.014(NS) |
| | | (0.031) | (0.032) | | | | | (0.035) | (0.032) | (0.050) | (0.041) |
| | Skin Cancer Risk Perception | | | | | - | - | | | | |
| | Skin Cancer Worry | | | | | 0.397 | 0.331 | - | - | 0.114 | 0.117 |
| | | | | | | (0.048) | (0.036) | | | (0.032) | (0.032) |
| | $R^2$ | 0.161 | 0.200 | 0.239 | 0.232 | 0.234 | 0.196 | 0.026 | 0.020 | 0.149 | 0.172 |

NS indicates non-significant coefficients, all other coefficients are significant at alpha = 0.05.

[1]Blank cell indicates that the particular path coefficient was not tested or was removed from the final model.

[2]The highlighted rows represent the standardized model path coefficients while the ones below (the ones that are not highlighted) represent the the standard errors for the respective path coefficients.

Hypothesis H3a proposed that skin cancer knowledge was positively related to online health information seeking behavior. After controlling for age, race, education and personal or family histories of skin cancer, the results confirm the hypothesis. One unit increase in the online health information index yields 0.198 unit increase in the skin cancer knowledge index (SE = 0.042, $p < .001$) among both sub-samples.

Among the control variables, age, race and education are significantly related to skin cancer knowledge as well. Higher education and lower age yield higher scores on the skin cancer knowledge index. In addition, Caucasians, compared to individuals of other ethnicities, report higher scores on the index. In terms of the magnitude of the predictors, the standardized solution highlights race ($\beta_{males}$ = 0.230, $p < 0.001$; $\beta_{females}$ = 0.247, $p < 0.001$), followed by education ($\beta_{males}$ = 0.204, $p < 0.001$; $\beta_{females}$ = 0.220, $p < 0.001$) and online health information seeking ($\beta_{males}$ = 0.141, $p < 0.001$; $\beta_{females}$ = 0.156, $p < 0.001$). Online health information seeking and the control variables explain 16.1 percent of the variance in skin cancer knowledge among males compared to 20.0 percent among females

Even though no hypotheses are formulated to predict online health information seeking, it is useful to acknowledge significant relationships between the control variables and online health information seeking index. The results show a negative relationship between age and online health information seeking (B = -0.039, SE = 0.003, $p < .001$) and a positive one between education and online health information seeking (B = 0.532, SE = 0.038, $p < .001$). Caucasians (B = 0.453, SE = 0.137, $p < .001$) and individuals with personal or family histories of cancer (B = 0.358, SE = 0.129, p = 0.003) report higher score on the online health information seeking index compared to their counterparts. In terms of the magnitude of the coefficients, age ($\beta_{males}$ = -0.295, $p < 0.001$; $\beta_{females}$ = -0.285, $p < 0.001$) and education ($\beta_{males}$ = 0.359, $p < 0.001$; $\beta_{females}$ = 0.349, $p < 0.001$) have the highest standardized values. Among males, roughly 23.9 percent of the variance in online health information seeking index is accounted for by the predictors compared to 23.2 percent among females.

The next set of hypotheses highlight skin cancer risk perceptions as the outcome variable. H3b proposed that, among males, skin cancer risk perceptions were negatively related to skin cancer knowledge and online health information seeking and positively related to skin cancer worry. H3c proposed that, among females, skin cancer risk perceptions were positively related to skin cancer knowledge, online health information seeking and skin cancer worry. Both H3b and H3c are partially supported. More specifically, risk perceptions are positively related to skin cancer knowledge among females (B = 0.031, SE = 0.017, p = 0.033). In addition, risk perceptions are also positively associated

with skin cancer worry among both gender groups ($B_{males}$ = 0.700, SE = 0.087, p < .001; $B_{females}$ = 0.475, SE = 0.0.055, p = < .001). In contrast to the proposed direction of H3c, among males, risk perceptions are positively related to online health information seeking.

Among the control variables, age, race and history of personal or family cancer significantly predict skin cancer risk perceptions. Age is negatively associated with risk perceptions (B = -0.009, SE = 0.002, p < .001). In addition, Caucasians (B = 0.477, SE = 0.078, p <.001) and individuals with history of personal or family cancer (B = 0.138, SE = 0.075, p = 032) report higher risk perceptions compared to their counterparts. In terms of the magnitude of the coefficients, the results highlight worry as having the highest standardized value ($\beta_{males}$ = 0.397, p < 0.001; $\beta_{females}$ = 0.331, p < 0.001) followed by race ($\beta_{males}$ = 0.196, p < 0.001; $\beta_{females}$ = 0.214, p < 0.001) and age ($\beta_{males}$ = -0.135, p < 0.001; $\beta_{females}$ = -0.148, p < 0.001). These predictors account for approximately 23.4 percent of the variance in skin cancer risk perceptions among males and 19.6 percent among females.

Hypotheses H3d and H3e emphasize skin cancer worry as the predicted variable. These hypotheses suggested that skin cancer worry was negatively related to skin cancer knowledge and online health information seeking among males, and positively related among females. H3e is fully supported; however, H3d is not supported. The results suggest that worry about developing skin cancer is positively related to skin cancer knowledge (B = 0.025, SE = 0.012, p = .017) and online health information seeking (B = 0.036, SE = 0.012, p = .002) among females. Moreover, the same positive relationships are encountered among males, which is in opposition with the hypothesized direction of H3d. Both predictors have a relatively low magnitude; their standardized coefficients are fairly small. None of the control variables are significant predictors of skin cancer worry. The predictors account for three percent of the variance in worry among males, and two percent among females.

Lastly, hypothesis H3f suggested that sunscreen usage was positively related to skin cancer knowledge, online health information seeking, skin cancer risk perceptions and skin cancer worry. H3f is only partially supported; sunscreen usage is positively related to online health information seeking ($B_{males}$ = 0.139, SE = 0.035, p < .001) among males and to skin cancer worry (B = .230, SE = 0.063, p <.001) among both gender groups. In addition, the control variables, race and education, are also significant predictors of sunscreen usage. Specifically, higher education yields more frequent sunscreen usage ($B_{males}$ = 0.118, SE = 0.055, p = 0.016; $B_{females}$ = 0.335, SE = 0.038, p < .001); and Caucasians, compared to individuals of other ethnicities, report higher frequency of sunscreen usage (B = 0.561, SE = 0.095, p < .001). In terms of the magnitude of the coefficients, the standardized results show similar

values for race, education, online health information seeking and skin cancer worry. These predictors account for 14.9 percent of the variance in sunscreen usage among males and 17.2 percent among females.

The unstandardized results depict two unequal paths between males and females among the proposed relationships. The relationship between worry and risk perceptions yields a higher coefficient among males compared to females. The relationship between online health information seeking and sunscreen usage yields a significant coefficient among males and a non-significant coefficient among females. Additionally the control variable education yields a higher coefficient among females compared to males. This study concludes that, among the skin cancer sample, there might be a basis for gender differences however additional tests need to be conducted to confirm them.

Appendix A (Table 7, Table 8a, Table 8b and Table 8c) presents the fit indices and the standardized path coefficients along with their respective standard errors and the variance explained for the three overall cancer samples. These results do not distinguish between males and females and thus, are not presented in this section as one of the main goals of this report is to compare gender groups. However, these overall results are included in Appendix A in the eventuality the reader wishes to compare them with the results reported in this chapter.

## Summary of Results

This study examined the relationships between online health information seeking, cancer knowledge, cancer risk perception, cancer worry and cancer-related behaviors for lung, colon and skin cancers. In addition, the predictive influence of certain background factors such as age, race, education and personal or family histories of cancer on the above mentioned variables was explored. Lastly, these relationships were also examined to determine gender differences between the proposed relationships. Several patterns emerged across these results.

For all three types of cancers, respondents' race, education and online health information seeking represent consistent predictors of cancer-related knowledge. Having higher education and seeking online health information are related to increased cancer knowledge. In addition, Caucasians, compared to their counterparts report higher score on the cancer knowledge index. Similarly, age, race, education and history of personal or family cancer are consistent predictors of online health information seeking across the various cancer samples. Lower age, higher education, Caucasian and personal or family histories of cancer yield higher score on the online health information seeking index.

A series of factors are consistent across cancers for explaining risk perceptions. Age, personal or family histories of cancer, cancer knowledge and worry are significantly related to risk perceptions. Lower age, higher frequency of worries and history of personal or family cancer are associated with higher risk perceptions across all three cancer types. However, knowledge yields opposing results for lung cancer versus colon and skin cancers. Higher lung cancer knowledge generates lower lung cancer risk perceptions, while higher colon and skin cancer knowledge yields higher colon and skin cancer risk perceptions. The reason for this inconsistency could not be determined. Other studies should examine these relationships to establish the grounds for these differences.

Even though some of the control variables or proposed predictors (such as online health information seeking and knowledge) significantly influence worries, none of these factors are consistent across cancer types. Moreover, the variance accounted for in worry by the predictors is extremely small across samples.

Lastly, only worries and risk perceptions seem to show a reasonably consistent pattern in explaining cancer related behaviors. Even though the direction of the relationships between worry and risk perceptions and the predicted variables are different depending on the type of cancer-related behavior influenced, they are generally consistent with previous research. Smokers and sedentary individuals report higher risk perceptions and worries about developing lung and colon cancer respectively. In addition, research suggests that individuals engage in harmful sun-related practices (tanning) and apply sunscreen simultaneously. In this study, the positive relationship between worry and sunscreen usage might be a consequence of the concurrent involvement in both tanning and sun-protective practices.

In terms of the relative importance of the predictors, some patterns are consistent across cancer types. Typically, the results indicate that education, race and online health information seeking have large standardized coefficients across outcomes. The standardized coefficients associated with age, history of personal of family cancer, cancer worry and cancer risk perceptions are generally smaller. This study does not support gender differences for the proposed relationships. Even though some gender differences are reported on certain relationships, these group dissimilarities are very few and are not consistent across cancer types.

Based on these patterns two models were proposed and explored for the three types of cancer. The first series of models maintains the same variables as the models described in the section above, however, it only includes the paths that are common across cancers. The next set of models excluded

cancer-related behavior from the model. The reason for this approach included the small portion of the variance explained in the health-related outcome by the predictors. Since gender differences were not observed across cancer types, these models assumed equal paths between males and females.

The exploratory analysis yielded reasonable fit indices for the first set of models and very good indices for the second set. Even though the individual path results are not presented in this study, the five fit indices for the lung, colon and skin cancer models are highlighted in Table 5 and Table 6. All these indices indicate a close fit of the proposed models to the data supporting the finding that these variables are consistent determinants of their respective outcomes across the three types of cancers.

Table 5. The Fit Indices[1] for the Proposed Lung Cancer, Colon Cancer and Skin Cancer Models with Initial Variables Included

| Model | $X^2$ *(df, p-value)* | CFI | TLI | RMSEA | SRMR |
|---|---|---|---|---|---|
| The Proposed Lung Cancer Model[2] | 44.989 (37, 0.17) | 0.989 | 0.984 | 0.015 | 0.024 |
| The Proposed Colon Cancer Model[3] | 79.501 (37, < .001) | 0.947 | 0.925 | 0.034 | 0.035 |
| The Proposed Skin Cancer Model[4] | 87.268 (37, < .001) | 0.916 | 0.882 | 0.040 | 0.046 |

[1] Interpretation Criteria for the Fit Indices: non-significant $X^2$, CFI and TLI coefficients greater than 0.95 and RMSEA and SRMR coefficients lower than 0.05 indicate good model fit.
[2,3,4] All models include the same paths with equality constrains.

Table 6. The Fit Indices[1] for the Proposed Lung Cancer, Colon Cancer and Skin Cancer Models without the Health Behavioral Outcome Variable

| Model | $X^2$ *(df)* | CFI | TLI | RMSEA | SRMR |
|---|---|---|---|---|---|
| The Proposed Lung Cancer Model[2] | 27.745 (23) | 0.992 | 0.988 | 0.015 | 0.022 |
| The Proposed Colon Cancer Model[3] | 27.789 (23) | 0.993 | 0.989 | 0.015 | 0.024 |
| The Proposed Skin Cancer Model[4] | 33.269 (23) | 0.984 | 0.974 | 0.023 | 0.028 |

[1] Interpretation Criteria for the Fit Indices: non-significant $X^2$, CFI and TLI coefficients greater than 0.95 and RMSEA and SRMR coefficients lower than 0.05 indicate good model fit.
[2,3,4] All models include the same paths with equality constrains.

Figure 9 depicts the paths from the exogenous to the endogenous variables for the first set of models while Figure 10 depicts the second set of models.

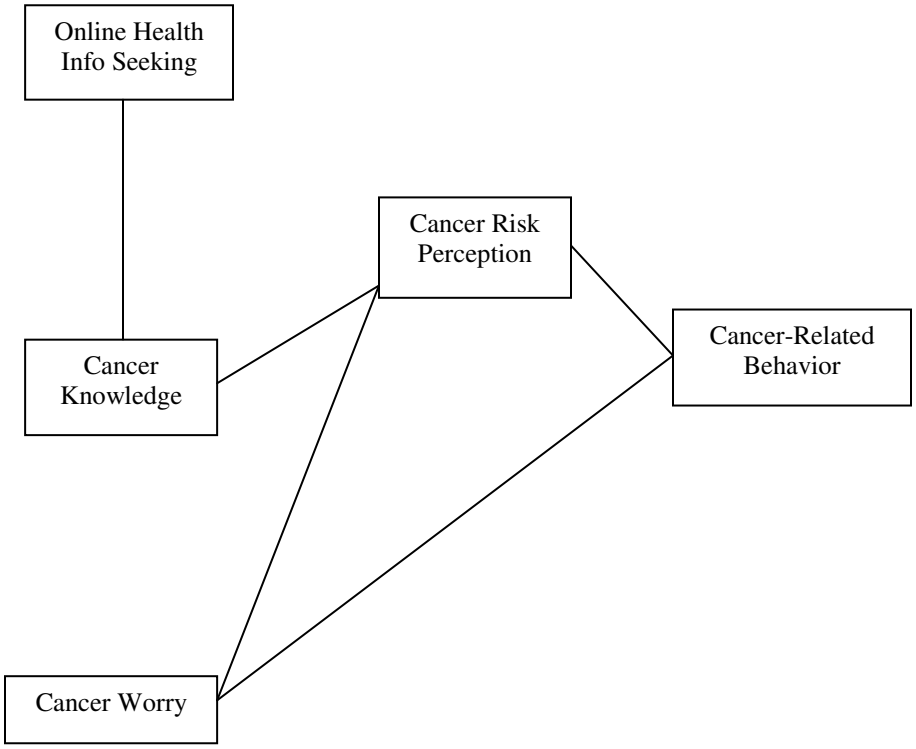



Figure 9. The Proposed Cancer Model with Initial Variables Included, Controlling for Age, Race, Education and Personal/Family History of Cancer.

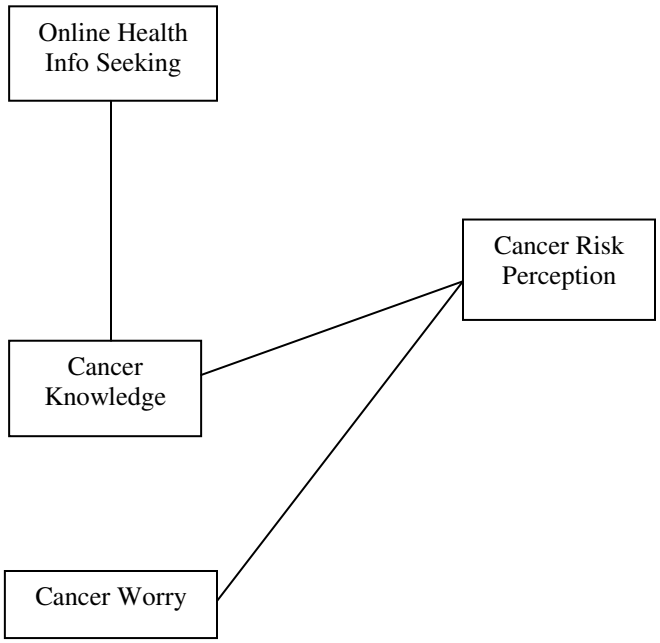



Figure 10. The Proposed Cancer Model without the Health Behavioral Outcome, Controlling for Age, Race, Education and Personal/Family History of Cancer.

# CHAPTER V
# DISCUSSION

The main objective of this study was to detect any differences or similarities between males and females in terms of cancer-related phenomena while the second objective included the detection of any common cancer patterns among the lung, colon and skin cancers. In the process, this study aimed to improve the cancer prevention efforts by including negative affect in the health model and exploring the risk-as-feelings hypothesis in association with cancer-related practices. The more recent literature suggests that affect plays a central role in health decisions; however, major health behavioral theories have addressed this issue limitedly.

Health communication represents a complex process that influences individuals' lives in a variety of forms including psychological, behavioral and social (Northouse and Northouse, 1998). To be able to modify aspects across these levels, individuals need to be addressed from multiple angles including emotional, logical and practical. Researchers have suggested that health efforts are often generalized and simplified (Baum, 2000). These investigators suggested that efforts need to be tailored based on demographic characteristics and inclusive of multiple aspects of one's lifestyle. This study sought to accomplish this goal by addressing gender difference related to the impact of cognitive and emotional factors on cancer-related behaviors.

In addition, most cancer research has focused on breast, prostate and colon cancer and adherence to screening practices. Limited research looked at other types or combinations of cancers and other types of cancer-related behaviors. This study explored similarities and differences among lung, colon and skin cancers with regards to smoking, exercise and sunscreen usage.

## Gender Differences

One of the main finding of this study is that the data do not support gender differences. While differences were noticed between males and females for certain relationships none of these showed a consistent pattern or were common across cancers. Even though research generally suggests that females, compared to males, have higher knowledge level, are more active health information seekers, report higher risk perceptions and negative affect and engage in more healthy behaviors, this study could not support a gender effect for the proposed relationships.

An exploratory analysis (t-tests and Mann-Whitney U test for independent samples) was conducted to test gender differences with regards to risk perception and worry in particular. The results of the exploratory analysis were mixed. There was no gender differences in terms of lung cancer risk perceptions and worry, colon cancer worry and skin cancer risk perceptions. Nonetheless, colon cancer risk perceptions were higher among males, compared to females, and skin cancer worry was higher among females compared to males. These findings and the ones resulted from the path analysis could indicate that males and females are becoming more similar with regards to their risk perceptions and worry.

There are several potential explanations for this lack of gender effect. The high prevalence of cancer prevention campaigns targeting males might have increased males' risk perceptions and worry related to developing cancer and made them more similar to their female counterparts. This is consistent with McQueen, Vernon, Meisnner and Radowski (2008). When comparing gender groups and their risk perceptions about gender-specific versus gender-neutral cancers, the researchers indicated that males and females differed from each other in terms of comparative risk perceptions for prostate/breast cancer, with males reporting higher risk perceptions. However, there were no differences between males and females' comparative risk perceptions in terms of colon cancer. Thus, it appears that males and females are more similar in their responses for cancers that are not gender specific, such as colon cancer. Since this study assessed risk perceptions and worry for cancer that are not gender specific, males are females might indeed be very similar in their responses.

Lastly, except for the skin cancer behavior, where females use sunscreen more frequently compared to males, the colon and lung cancer behaviors examined in this study show similar patterns in the population between males and females. Specifically, with regards to smoking, the gap between the two gender groups is only five percent (MMWR(c), 2007). In terms of physical activity, 32.9 percent of males reported regular exercise compared to 28.9 percent of females (CDC-Leisure Time Physical Activity, 2008). Consequently, similar involvement in harmful behaviors as well as healthy practices between males and females might yield similar risk factors which might transfer to perceptions and emotions. Based on the results of the study, it appears that gender is not a major factor in predicting cancer risk perceptions or worry.

## Risk-as-Feeling Hypothesis

Most health theorists have overlooked the role of affect in health decisions while current research indicates that affect plays an essential part in the adoption of health behaviors especially cancer screenings. This study explored the impact of negative affect, particularly worry, on involvement in other types of cancer-related practices such as smoking, physical activity and sunscreen usage. For the most part, the findings supported the positive role of emotions on health behaviors nevertheless this influence was very small and explained very little of the variance in the cancer-related outcome. Worry and risk perceptions seem to explain involvement in cancer screening behaviors more than they do smoking, exercise or sunscreen usage. One possibility for this different influence is that there is more awareness of the relationship between screening for cancer and reduction of cancer risk compared to exercise or sunscreen usage as cancer reducing strategies (Bowen, Alfano, McGregor & Andersen, 2004).

Moreover, screening provides a tangible aspect, an immediate result. Consequently, people who report higher anxiety levels towards developing cancer might be more likely to engage in screening behaviors to help them diminish the negative emotional activity or to motivate them to pursue other health actions. In contrast, the cancer-related behaviors addressed in this study cannot provide this benefit and consequently high level of risk perceptions or worry might not be conducive to higher involvement in protective behaviors.

The most noticeable finding with regards to the risk-as-feeling hypothesis and the dual process theory approach is the strong association between emotions and cognitions. Worry was the common indicator of risk perceptions across all three cancers suggesting that the relationship might stand across multiple health issues. Moreover, in terms of magnitude, worry placed first on predicting risk perceptions across the three types of cancer. Considering that previous research has advocated a unidirectional relationship from worry to risk perceptions, this study brought more support to the principles advocated by the risk-as-feelings hypothesis.

## One Cancer Model

The final major finding includes the proposal of a common model across the three types of cancers. The path analysis results for the individual cancers indicate several general characteristics including race, education, cancer history and online health information seeking as predictors of knowledge; age, race, education and cancer history as predictors of online health information seeking;

age, cancer history, cancer knowledge and worry as predictors of risk perceptions; and risk perceptions and worry as predictors of cancer-related behaviors. The proposed models (both sets) showed a fairly good overall fit confirming that certain determinants have a consistent influence on the outcomes regardless of the type of cancer.

In addition, in Chapter II, this study indicated that the three cancers have different preventability and curability levels and require adherence or cessation of cancer-related behaviors that have different levels of complexity. The chapter suggested that because of these characteristics the models and the results might be different depending on the type of cancer. Generally, it seems that these characteristics do not influence the relationships between variables since one model was proposed across cancers. The multitude of cancer campaigns that have used fear to persuade individuals to adopt healthy practices, have helped cancer become one of the most feared health condition (Clarke & Everest, 2006; Moriarty & Stryker, 2008). As a result, individuals might not rely on the specifics of the cancer to judge risk or adopt/cease cancer-related behaviors but just judge cancer as a whole.

## Individual Results

Even though history of personal or family cancer was expected to have a major role in predicting behaviors, perceptions and feelings, its contribution was fairly small. The large percentage of individuals with cancer histories might have determined a limited impact of personal or family histories of cancer on its respective outcomes.

Interestingly, results support the presence of a digital divide, indicating that younger adults, Caucasians and higher educated individuals seek online health-related information more compared to their counterparts. This is consistent with other research which suggested that despite recent improvements in access to Internet, there was still segregation between the upper and the lower social strata in terms of their health information seeking behaviors (Cline & Haynes, 2001; Korp, 2006). In addition, the findings are also consistent with the knowledge-gap hypothesis which suggests that upon the introduction of health campaigns or health information, segments of the population in the higher social stratum tend to acquire information at a faster rate and benefit from it more compared to their counterparts in the lower stratum (Shim, 2008). In this study, Caucasians and higher educated individuals reported higher scores on the cancer-related knowledge indices.

The relationship between healthy behaviors and their determinants needs further explanations. Cross sectional studies are more difficult to interpret compared to prospective studies because they

cannot exclude the influence of health behavior on its determinants (Brewer et al., 2007). Since both factors (the predicted and predictor variables) are assessed simultaneously, both elements can influence each other. In prospective studies, researchers can make stronger arguments that risk perceptions motivate health behavior rather than the reported risk perception is constructed as a result of involvement in the health behavior (in cross-sectional studies) (Brewer et al., 2007). The bias of cross-sectional study design might have occurred in this study.

The results suggest a positive relationship between risk perceptions and worry and cigarette smoking. It is reasonable to assume that the direction of the relationship indicates that smokers, compared to non- or former smokers, report higher risk perceptions and worries about developing lung cancer because of their involvement in the harmful behavior. Weinstein, Rothman and Nicolich (1998) suggested that in cross-sectional data risk perceptions do not predict future involvement in healthy practices but rather they indicate the "relative accuracy" of the risk perceptions. This accuracy depicts the relationship between perceived risk and the number of precautionary behaviors the person is performing at the time of the interview. Similarly, among the colon cancer sample, individuals who engage in higher levels of physical activity report lower risk perceptions. It would be expected that in prospective studies the relationship between these factors to be reversed.

In addition, research has suggested other factors as predictors of exercise. For instance, health professionals have noted that people are more likely to engage in physical activity if they have a support group and if they have available resources (Carron, Hausenblas & Mack, 2007; Giles-Corti, & Donovan, 2002). It is possible that people who reported lower risk perceptions and worries met the conditions that facilitated exercising while their counterparts did not. These variables were not accounted for in this study, thus their influence on exercising habits could not be excluded. Future studies should take into consideration these factors to better assess the relationship between risk perceptions, worry and physical activity.

The relationship between worry and sunscreen usage is consistent with previous research. Other findings have found that individuals engage in both tanning behaviors and sun-safe practices simultaneously (Clarke, Williams & Arthey, 1997). As a result, a positive relationship could emerge between worry and sunscreen usage. On one hand, adherence to sun-safe practices reduces worries, and on the other, the use of tanning beds or other tanning devices increases worries.

To conclude, this study is significant in several ways. It enhances the applications of the risk-as-feeling hypothesis to other health issues, it explores gender differences with regards to cancer-related

phenomena and it promotes a general cancer model that could later be tailored and expanded to address attitudes and behaviors related to specific cancers.

This study is particularly relevant for health communicators and social marketers. It shows that emotions play a role in adherence to healthy practices but more importantly they play a central role in risk perceptions. Thus, addressing and controlling individuals' emotional activity can help increase risk perceptions and in turn increase the effectiveness of health communication efforts. This report restates the importance of including emotional and logical elements in health campaign messages.

In addition, this study continued to raise awareness about the presence of a digital divide and the gap in knowledge between the well off and less well of in society. The Internet might function as a significant health tool for people who are in possession of knowledge. More efforts should be geared not only towards providing health information on the Internet and increasing access to the Internet but also towards increasing individuals' ability to look for health information and evaluate relevant health strategies.

## Limitations

One of the major constraints of this study is the low variance explained in cancer-related behaviors and worry. While, the proposed predictors explained roughly 20 percent of the variance in online health information seeking, cancer-related knowledge, risk perceptions and sunscreen usage, they explained less than five percent of the variation in other cancer related behaviors and worry. It seems that there are other predictors that can account for the variation in these factors. For instance, the portion of explained variation in cigarette smoking can be improved by variables such as length and quantity of smoking, age of smoking initiation, family or friends smoking and smoking cessation attempts. The percent of variance explained in exercise can be influenced by family and friends lifestyles, availability of group exercising and neighborhood resources. Lastly, factors such as personality characteristics including self-efficacy and locus of control, fatalistic nature of individuals and the recency of the cancer diagnosis might be better predictors of worry.

Availability of appropriate variables that can enhance the analysis and better answer the proposed hypotheses is typically one of the major limitations of secondary analysis. One such limitation concerns the knowledge index and the constructs of risk perceptions and worry. The majority of items that were available to be considered for the knowledge index were not able to discriminate very well between respondents' knowledge levels. Despite this limitation, the reliability coefficient for the index was

similar to other reliability coefficients reported in prior health research. This suggests that future research should focus on the development of a more reliable cancer-related knowledge scale.

Research indicates that the use of a single item with few response categories can limit the variance available to be explained (McQueen, Vernon, Radowski & Meissner, 2008). Both risk perceptions and feelings of worry were measured through a single item that featured five and four response categories respectively. Moreover, roughly three quarters of respondents indicated very low risk perceptions and rare or absent worries which contributed to low variability as well. Thus, the error of the variance might have increased and the role of risk perceptions and worry underestimated due to the multi-faced aspect of the construct and respondents' inability to interpret it through a single-item low response category measure. In addition, because of its few response options, the measure might have had limited ability to clearly distinguish between respondents who had high risk perceptions or worries compared to those that had low risk perceptions and worries.

Despite these series of limitations, several of the control variables and proposed predictors were significantly associated with risk perceptions and worry and explained a larger part of the variance in risk perceptions. In addition, worry and risk perceptions accounted for a portion of the variance in cancer-related behaviors. This indicates that with better measures, risk perceptions and worry might yield important insights to improve health communication processes aimed at reducing cancer mortality. Conceptual and psychometric advancement in the measure of perceived risk and worry are needed (Hay, Buckley & Ostroff, 2005; Consedine et al., 2004). Research is already moving in this direction as recently, researchers such as Hirai et al. (2008) have developed a specific cancer worry inventory.

The cross-sectional level of this data adds to the set of limitations described so far. Even though this study draws conclusions about the influence of exogenous variables, they are largely based on the association coefficients between the independent and the dependent factor and on the empirical evidence and theoretical assumptions. To be able to make stand-alone claims of prediction and confirm the pathways found in this study, a longitudinal or experimental study design should be employed.

Lastly, this study was unable to employ all the required weighting procedures. The final sampling weight was a function of the base weight and the non-response and the post-stratification adjustments (described in Chapter III) which yielded accurate representation of the population of interest and accurate point estimates. Due to software limitations, the Jackknife replicate weights were omitted from the analysis which may have impacted the estimation of the variance. However, a robust analysis was employed to determine the standard errors, which was expected to partly overcome this limitation.

## Future Research

Programs designed to prevent the onset of cancer and promote a disease-free lifestyle should take into consideration the findings reported in this study. Future research should take into consideration the limitations of this study and include other variables that are relevant to the prediction of worry and health behaviors. Other studies should examine gender differences with regards to cancer to confirm the lack of a gender effect found in this study.

Since the proposed variables are strongly related to adherence to screening but not to other cancer-related practices, future research should explore these differences to better understand the mechanisms behind these inconsistencies and confirm the reasons why worry and risk perceptions have a strong influence on screening behaviors but only a limited one on other cancer-related practices. In addition, the proposed model controlled for individuals' educational level while examining the relationships between knowledge and its endogenous factors. Controlling for education might have attenuated the influence of knowledge yielding lower coefficients. Future studies should avoid including education as a control variables when examining the influence of individuals' objective knowledge. Future studies should also consider the addition of a measurement model. This would facilitate a better representation of constructs such as negative affect and risk perceptions.

Furthermore, the design of the study imposed several limitations on the interpretation of the coefficients. Thus, researchers should consider the use of longitudinal data which can help investigators make stronger claims about the effect of worry on risk perceptions and about their influence on health behaviors. Lastly, as new software develop and more options become available, future research could examine the proposed relationships again and assess the biases resulted from using a conventional weighting approach (a general sampling weight) versus using a more advanced weighting method such as the Jackknife replications.

# APPENDIX A

## FIT INDICES AND STANDARIZED RESULTS FOR THE LUNG, COLON AND SKIN CANCER MODELS AMONG THE TOATAL SAMPLE

Table 7. The Fit Indices[1] for the Lung Cancer, Colon Cancer and Skin Cancer Models among the Total Sample (TS) of Respondents

| Model | $X^2$ *(df, p-value)* | CFI | TLI | RMSEA | SRMR |
|---|---|---|---|---|---|
| The TS Lung Cancer Model[2] | 11.080 (13, 0.60) | 1.000 | 1.007 | 0.000 | 0.014 |
| The TS Colon Cancer Model[3] | 9.383 (9, 0.40) | 0.999 | 0.998 | 0.005 | 0.013 |
| The TS Skin Cancer Model[4] | 5.574 (10, 0.84) | 1.000 | 1.019 | 0.000 | 0.01 |

[4] Interpretation Criteria for the Fit Indices: non significant $X^2$, CFI and TLI coefficients greater than 0.95 and RMSEA and SRMR coefficients lower than 0.05 indicate good model fit.

[1] The TS Lung Cancer Model represents the same model as the model in Table 2c except it is among the total sample of respondents.

[2] The TS Colon Cancer Model represents the same model as the model in Table 3c except it is among the total sample of respondents.

[3] The TS Skin Cancer Model represents the same model as the model in Table 4c except it is among the total sample of respondents.

Table 8a. The Standardized Path Coefficients and Their Standard Errors for the Lung Cancer Model for the Total Sample ($n_{total}$ = 1,872)[1,2]

| | | Predicted Variables | | | | |
|---|---|---|---|---|---|---|
| | | Lung Cancer Knowledge | Online Health Info Seeking | Lung Cancer Risk Perception | Lung Cancer Worry | Cigarettes Smoked in the Past 30 Days |
| Control Variables | Age | | -0.288* | -0.053* | -0.060* | |
| | | | 0.031 | 0.032 | 0.030 | |
| | Race (Caucasian) | 0.180* | 0.079* | | | |
| | | 0.038 | 0.034 | | | |
| | Education | 0.231* | 0.357* | | -0.161* | |
| | | 0.031 | 0.026 | | 0.027 | |
| | Cancer History (Pers./Fam.) | 0.079* | 0.072* | 0.086* | 0.092* | |
| | | 0.031* | 0.029 | 0.030* | 0.030 | |
| Predictor Variables | Lung Cancer Knowledge | - | | -0.066(NS) | | |
| | | | | 0.041 | | |
| | Online Health Info Seeking | 0.169* | - | | | |
| | | 0.030 | | | | |
| | Lung Cancer Risk Perception | | | - | | 0.163* |
| | | | | | | 0.031 |
| | Lung Cancer Worry | | | 0.461* | - | 0.105* |
| | | | | 0.040 | | 0.036 |
| | $R^2$ Total Sample | 0.192 | 0.238 | 0.236 | 0.034 | 0.054 |

*Coefficients are significant at alpha = 0.05.

NS indicates non-significant coefficient.

[1]Blank cell indicates that the particular path coefficient was not tested or was removed from the final model.

[2]The highlighted rows represent the standardized model path coefficients while the ones below (the ones that are not highlighted) represent the standard errors for the respective path coefficients.

Table 8b. The Standardized Path Coefficients and Their Standard Errors for the Colon Cancer Model for the Total Sample ($n_{total}$ = 1,978)[1,2]

| | | Predicted Variables | | | | |
|---|---|---|---|---|---|---|
| | | Colon Cancer Knowledge | Online Health Info Seeking | Colon Cancer Risk Perception | Colon Cancer Worry | Minutes of Exercise Per Week |
| Control Variables | Age | 0.206* | -0.305* | -0.116* | | -0.179* |
| | | 0.028 | 0.026 | 0.035 | | 0.046 |
| | Race (Caucasian) | 0.161* | 0.108* | 0.106* | -0.160* | |
| | | 0.028 | 0.032 | 0.041 | 0.042 | |
| | Education | 0.244* | 0.358* | | -0.156* | |
| | | 0.030 | 0.026 | | 0.033 | |
| | Cancer History (Pers./Fam.) | | 0.055* | 0.069* | 0.052(NS) | 0.045(NS) |
| | | | 0.029 | 0.035 | 0.035 | 0.038 |
| Predictor Variables | Colon Cancer Knowledge | - | | 0.062* | 0.067* | |
| | | | | 0.035 | 0.032 | |
| | Online Health Info Seeking | 0.255* | - | | | -0.180* |
| | | 0.030 | | | | 0.028 |
| | Colon Cancer Risk Perception | | | - | | -0.063(NS) |
| | | | | | | 0.046 |
| | Colon Cancer Worry | | | 0.331* | - | |
| | | | | 0.045 | | |
| | $R^2$ Total Sample | 0.249 | 0.261 | 0.131 | 0.050 | 0.047 |

*Coefficients are significant at alpha = 0.05.

NS indicates non-significant coefficient.

[1]Blank cell indicates that the particular path coefficient was not tested or was removed from the final model.

[2]The highlighted rows represent the standardized model path coefficients while the ones below (the ones that are not highlighted) represent the standard errors for the respective path coefficients.

Table 8c. The Standardized Path Coefficients and Their Standard Errors for the Skin Cancer Model for the Total Sample ($n_{total}$ = 1,736)[1,2]

| | | Predicted Variables | | | | |
|---|---|---|---|---|---|---|
| | | Skin Cancer Knowledge | Online Health Info Seeking | Skin Cancer Risk Perception | Skin Cancer Worry | Sunscreen Usage |
| Control Variables | Age | -0.063* | -0.269* | -0.129* | | |
| | | 0.031 | 0.032 | 0.036 | | |
| | Race (Caucasian) | 0.226* | 0.109* | 0.202* | | 0.176* |
| | | 0.03 | 0.037 | 0.038 | | 0.033 |
| | Education | 0.195* | 0.352* | | | 0.196* |
| | | 0.031 | 0.027 | | | 0.031 |
| | Cancer History (Pers./Fam.) | | 0.073* | 0.054(NS) | | |
| | | | 0.03 | 0.033 | | |
| Predictor Variables | Skin Cancer Knowledge | - | | 0.061(NS) | 0.090* | |
| | | | | 0.046 | 0.043 | |
| | Online Health Info Seeking | 0.180* | - | | 0.103* | 0.117* |
| | | 0.031 | | | 0.033 | 0.032 |
| | Skin Cancer Risk Perception | | | - | | |
| | Skin Cancer Worry | | | 0.362* | - | 0.132* |
| | | | | 0.031 | | 0.031 |
| | $R^2$ Total Sample | 0.181 | 0.219 | 0.206 | 0.024 | 0.148 |

*Coefficients are significant at alpha = 0.05.

NS indicates non-significant coefficient.

[1]Blank cell indicates that the particular path coefficient was not tested or was removed from the final model.

[2]The highlighted rows represent the standardized model path coefficients while the ones below (the ones that are not highlighted) represent the standard errors for the respective path coefficients.

APPENDIX B

VARIANCE-COVARIANCE MATRICES FOR THE LUNG, COLON AND SKIN CANCER SUB-SAMPLES

Table 9a. The Variance-Covariance Matrix for the Lung Cancer Male Sub-Sample

| | Lung Cancer Knowledge | Online Health Information Seeking | Lung Cancer Risk Perception | Lung Cancer Worry | Cigarettes Smoked in the Past 30 Days |
|---|---|---|---|---|---|
| Lung Cancer Knowledge | 4.704 | | | | |
| Online Health Information Seeking | 1.056 | 3.348 | | | |
| Lung Cancer Risk Perception | -0.121 | -0.141 | 1.424 | | |
| Lung Cancer Worry | -0.127 | -0.009 | 0.375 | 0.488 | |
| Cigarettes Smoked in the Past 30 Days | -10.07 | -2.218 | 9.055 | 5.229 | 1507.152 |
| Age | 1.035 | -5.701 | -0.503 | -0.46 | -5.086 |
| Any Cancer History | 0.179 | 0.137 | 0.058 | 0.016 | 0.271 |
| Race | 0.343 | 0.157 | -0.038 | -0.012 | -1.042 |
| Education | 1.078 | 1.060 | -0.193 | -0.119 | -1.348 |

| | Age | Cancer History (Pers./Fam.) | Race | Education |
|---|---|---|---|---|
| Age | 288.064 | | | |
| Cancer History (Pers./Fam.) | 0.622 | 0.221 | | |
| Race | 1.942 | 0.034 | 0.221 | |
| Education | 2.872 | 0.114 | 0.232 | 1.683 |

Table 9b. The Variance-Covariance Matrix for the Lung Cancer Female Sub-Sample

| | Lung Cancer Knowledge | Online Health Information Seeking | Lung Cancer Risk Perception | Lung Cancer Worry | Cigarettes Smoked in the Past 30 Days |
|---|---|---|---|---|---|
| Lung Cancer Knowledge | 4.213 | | | | |
| Online Health Information Seeking | 1.296 | 4.168 | | | |
| Lung Cancer Risk Perception | -0.242 | -0.081 | 1.338 | | |
| Lung Cancer Worry | -0.056 | -0.112 | 0.376 | 0.429 | |
| Cigarettes Smoked in the Past 30 Days | 0.444 | 1.025 | 6.289 | 2.456 | 404.729 |
| Age | -4.013 | -13.399 | -2.011 | -0.609 | -1.851 |
| Cancer History (Pers./Fam.) | 0.088 | 0.004 | 0.054 | 0.027 | 0.48 |
| Race | 0.201 | 0.082 | -0.023 | -0.023 | -0.106 |
| Education | 0.763 | 0.831 | -0.204 | -0.131 | -0.614 |

| | Age | Cancer History (Pers./Fam.) | Race | Education |
|---|---|---|---|---|
| Age | 317.935 | | | |
| Cancer History (Pers./Fam.) | 0.589 | 0.17 | | |
| Race | 0.702 | 0.029 | 0.198 | |
| Education | -3.64 | -0.012 | 0.076 | 1.369 |

Table 9c. The Variance-Covariance Matrix for the Colon Cancer Male Sub-Sample

| | Colon Cancer Knowledge | Online Health Info Seeking | Colon Cancer Risk Perception | Colon Cancer Worry | Minutes of Weekly Exercise | Age |
|---|---|---|---|---|---|---|
| Colon Cancer Knowledge | 3.561 | | | | | |
| Online Health Information Seeking | 1.273 | 3.518 | | | | |
| Colon Cancer Risk Perception | 0.149 | 0.139 | 1.056 | | | |
| Colon Cancer Worry | -0.042 | -0.057 | 0.161 | 0.373 | | |
| Minutes of Weekly Exercise | -142.852 | -202.615 | -80.144 | -32.050 | 646,044.19 | |
| Age | 5.223 | -7.466 | -1.775 | 1.011 | -2,211.99 | 307.513 |
| Cancer History (Pers./Fam.) | 0.095 | 0.091 | 0.055 | 0.010 | 2.049 | 1.083 |
| Race | 0.247 | 0.164 | 0.055 | -0.065 | -10.781 | 0.934 |
| Education | 0.985 | 1.080 | 0.001 | -0.151 | -33.157 | 0.125 |

| | Cancer History (Pers./Fam.) | Race | Education |
|---|---|---|---|
| Cancer History (Pers./Fam.) | 0.201 | | |
| Race | 0.064 | 0.205 | |
| Education | 0.090 | 0.178 | 1.683 |

Table 9d. The Variance-Covariance Matrix for the Colon Cancer Female Sub-Sample

| | Colon Cancer Knowledge | Online Health Info Seeking | Colon Cancer Risk Perception | Colon Cancer Worry | Minutes of Weekly Exercise | Age |
|---|---|---|---|---|---|---|
| Colon Cancer Knowledge | 4.093 | | | | | |
| Online Health Information Seeking | 1.156 | 4.120 | | | | |
| Colon Cancer Risk Perception | 0.173 | -0.045 | 0.877 | | | |
| Colon Cancer Worry | -0.032 | -0.117 | 0.193 | 0.323 | | |
| Minutes of Weekly Exercise | -36.179 | -80.278 | -17.423 | -4.073 | 156,876.68 | |
| Age | 4.114 | -13.751 | -0.587 | 0.056 | -181.714 | 332.889 |
| Cancer History (Pers./Fam.) | 0.088 | 0.044 | 0.029 | -0.007 | 4.624 | 0.942 |
| Race | 0.273 | 0.133 | 0.010 | -0.025 | 12.292 | 1.355 |
| Education | 0.946 | 0.988 | 0.005 | -0.102 | -49.692 | -2.370 |

| | Cancer History (Pers./Fam.) | Race | Education |
|---|---|---|---|
| Cancer History (Pers./Fam.) | 0.182 | | |
| Race | 0.040 | 0.207 | |
| Education | 0.031 | 0.109 | 1.595 |

Table 9e. The Variance-Covariance Matrix for the Skin Cancer Male Sub-Sample

| | Skin Cancer Knowledge | Online Health Information Seeking | Sunscreen Usage | Skin Cancer Risk Perception | Skin Cancer Worry | Age |
|---|---|---|---|---|---|---|
| Skin Cancer Knowledge | 6.838 | | | | | |
| Online Health Information Seeking | 1.541 | 3.241 | | | | |
| Sunscreen Usage | 0.411 | 0.638 | 1.666 | | | |
| Skin Cancer Risk Perception | 0.409 | 0.076 | 0.222 | 1.261 | | |
| Skin Cancer Worry | 0.198 | 0.134 | 0.133 | 0.295 | 0.416 | |
| Age | -3.096 | -5.426 | -0.153 | -0.764 | -0.228 | 289.604 |
| Cancer History (Pers./Fam.) | 0.061 | 0.067 | 0.058 | 0.046 | 0.017 | 0.656 |
| Race | 0.302 | 0.128 | 0.124 | 0.095 | -0.005 | 1.958 |
| Education | 0.912 | 0.824 | 0.381 | 0.107 | 0.064 | 1.620 |

| | Cancer History (Pers./Fam.) | Race | Education |
|---|---|---|---|
| Cancer History (Pers./Fam.) | 0.183 | | |
| Race | 0.032 | 0.216 | |
| Education | 0.067 | 0.120 | 1.553 |

Table 9f. The Variance-Covariance Matrix for the Skin Cancer Female Sub-Sample

| | Skin Cancer Knowledge | Online Health Information Seeking | Sunscreen Usage | Skin Cancer Risk Perception | Skin Cancer Worry | Age |
|---|---|---|---|---|---|---|
| Skin Cancer Knowledge | 6.049 | | | | | |
| Online Health Information Seeking | 1.285 | 3.900 | | | | |
| Sunscreen Usage | 0.84 | 0.485 | 2.124 | | | |
| Skin Cancer Risk Perception | 0.552 | 0.321 | 0.153 | 1.148 | | |
| Skin Cancer Worry | 0.203 | 0.185 | 0.148 | 0.292 | 0.547 | |
| Age | -1.277 | -10.406 | 1.518 | -2.483 | -1.217 | 317.882 |
| Cancer History (Pers./Fam.) | 0.069 | 0.100 | 0.045 | 0.050 | 0.017 | 1.030 |
| Race | 0.371 | 0.109 | 0.204 | 0.115 | 0.026 | 2.493 |
| Education | 1.105 | 1.009 | 0.641 | 0.118 | 0.038 | -1.647 |

| | Cancer History (Pers./Fam.) | Race | Education |
|---|---|---|---|
| Cancer History (Pers./Fam.) | 0.181 | | |
| Race | 0.043 | 0.229 | |
| Education | 0.054 | 0.144 | 1.618 |

APPENDIX C

HUMAN SUBJECT APPROVAL LETTER

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 Â· FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 11/17/2008

To: Mihaela Moldovan [mmoldovan@fsu.edu]

Address: 1816F Jackson Bluff Rd
Dept.: COMMUNICATION

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
Risk Perceptions, Worry and Communication as Predictors of Protective Behaviors Preventing Colon, Lung and Skin Cancers

The application that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and two members of the Human Subjects Committee. Your project is determined to be Expedited per 45 CFR Â§ 46.110(5) and has been approved by an expedited review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 11/13/2009 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal

regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc: Gary Heald, Advisor [gheald@fsu.edu]
HSC No. 2008.1878

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# BIOGRAPHICAL SKETCH

Mihaela Moldovan was born in Constanta and lived in Bucharest, Romania until 2002 when she came to the United States. After graduating from Emil Racovita High School in Bucharest, Romania, she attended Florida State University where she majored in Public Relations with a minor in Business. Mihaela graduated *magna cum laude* in 2005. During her undergraduate studies, she was a member of the Varsity Women's Tennis Team where she became All-American in 2005.

Mihaela enrolled in the graduate program in the Department of Communication in Summer, 2005. She earned a Masters of Arts degree in Integrated Marketing Communication in Fall, 2006 a Ph.D. in Communication Theory and Research in Summer, 2009. During her graduate work in the United States Mihaela Moldovan taught undergraduate students in the areas of public speaking, communication research methods and integrated marketing communication. In her research, Mihaela Moldovan's areas of interest feature minority health, with special emphasis on Hispanic health, cancer prevention, and health campaign evaluations.