AN EXAMINATION OF THE PERSONAL CANCER SCREENING BEHAVIORS OF ONCOLOGY HEALTH CARE PROFESSIONALS AND THE FACTORS THAT INFLUENCE THEIR CANCER SCREENING DECISIONS

A Doctoral Thesis Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Education

by

Kimberly Tripp

August 2018

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Dedication

To my husband and two beautiful children, Derrick, Derrick II and Kelise, who inspired me with constant laughter, unconditional love, and unwavering support. Your sacrifice made all of this possible.

Acknowledgement

First and foremost, I would like to thank my Lord and Savior for placing the goal in my mind and the desire in my heart to pursue this academic dream. It is by His strength that I was able to persevere to the very end. I would also like to acknowledge my entire support structure, both personally, professionally, and academically.

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ABSTRACT

Background: Oncology health care professionals are not only reliable sources of health information, but health role models who play a key role in helping patients adopt screening and other prevention- related practices. Despite clearly defined, evidence-based guidelines for cancer screening, there is a lack of evidence about cancer providers' personal adherence to these recommendations. **Purpose**: This study examined the personal adherence of oncology health care professionals to determine consistency with cancer screening guidelines for cervical, breast, and colorectal cancers as well as the factors that influence their personal cancer screening decisions. **Methods**: This quantitative study surveyed a convenience sample of oncology health care professionals at a comprehensive cancer center to evaluate the relationships between knowledge of cancer screening guidelines, perceptions and beliefs about cancer and screening, and cancer screening behavior using descriptive statistics and logistic regression models. The instruments that were used included the Health Information National Trends Survey (HINTS), the Champion Health Belief Model (CHBM), and the Behavioral Risk Factor Surveillance System (BRFSS) for cervical, breast, and colorectal cancer. **Results**: Results demonstrated adherence rates of 91.5% for Pap tests, 82.8% for HPV testing, 85.2% for mammography, and 100.0% for colonoscopy screening when blood tests and endoscopy were combined. Statistically significant relationships existed between some, but not all of the CHBM factors, knowledge, and cancer screening outcomes. **Conclusion**: Although oncology health care professionals are adherent to cancer screening guidelines for cervical, breast, and colorectal cancers, researchers should continue to explore the factors that explain their adherence.

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Chapter I

Introduction

Background

Cancer has plagued the world throughout recorded history with some of the earliest evidence documented as far back as 3,000 BC in fossilized bone, human mummies, and manuscripts from ancient Egypt (American Cancer Society [ACS], 2014c). However, it was not until the early 1900s that prominent cancer advocacy associations were established worldwide. In March of 1930, leading cancer researchers, advocates, and other cancer specialists testified before the Senate Commerce Committee about cancer incidence in the United States, possible cures, and the need for a national clinic. Their swaying testimony paved the way for national cancer legislation in the United States (National Cancer Institute [NCI], 2015). The National Cancer Act of 1937 established the National Cancer Institute (NCI) as the federal government's primary agency for conducting, coordinating, and promoting cancer related research; receiving advice from cancer experts in the United States and abroad; cooperating with state health agencies in the prevention, control, and eradication of cancer; and collecting, analyzing, and disseminating the results of cancer research worldwide (NCI, 2015).

In 1971, United States President Richard Nixon signed a second National Cancer Act, which led to creation of the National Cancer Program, establishment of the President's Cancer Panel, and funding for cancer control programs, including the Surveillance, Epidemiology, and End Results (SEER) program to collect and analyze U.S. cancer incidence, survivorship, and mortality data (NCI, 2015). Although the history of cancer control dates back to 1913 (Breslow, Agran, Breslow, Morganstern, & Ellwein,

1977), cancer control research was eventually defined by Abrams (1997) as “the conduct of basic and applied research in the behavioral, social, and population sciences that, independently, or in combination with biomedical approaches, reduces cancer risk, incidence, morbidity, and mortality and improves quality-of-life” (p. 7). In 1985, that definition was modified by Greenwald and Cullen and defined as as “the reduction of cancer incidence, morbidity, and mortality through an orderly sequence from research on interventions and their impact in defined populations to the broad, systematic application of the research results” (p. 543). Finally, in 1998, the Centers for Disease Control and Prevention (CDC) established the National Comprehensive Cancer Control Program (NCCP) to support a collaborative and strategic approach for communities to combine, share, and coordinate resources to reduce the burden of cancer. Comprehensive Cancer Control (CCC) plans were then promoted at the state level to focus on current and emerging cancer issues, including cancer prevention, early detection, treatment, rehabilitation, and survivorship. Today, CCC plans exist in all 50 states, the District of Columbia, seven tribes and tribal organizations, and seven U.S. territories (Centers for Disease Control and Prevention [CDC], 2015).

The CCC plan for Texas, known as the Texas Cancer Plan (TCP), was developed as a statewide blueprint to identify goals, objectives, and strategic actions that address the entire spectrum of cancer prevention and control in Texas (Cancer Prevention and Research Institute of Texas [CPRIT], 2012). In fact, by state statute (Texas Health and Safety Code, 1989), the Cancer Prevention and Research Institute of Texas (CPRIT) is charged with facilitating the development and implementation of the TCP (CPRIT, 2012). This is because the human cost of cancer is staggeringly high. Cancer is the

leading cause of death for Texans under the age of 85 with an estimate of over 109,000 cancer diagnoses in 2015 and over 42,000 deaths (CPRIT, 2012, 2015). Just as concerning for Texans is the total economic burden of cancer, with an estimated $31.3 billion spent in 2015 alone, including the cost of direct medical care and lost productivity from illness and premature death (CPRIT, 2015). Yet, the human and economic toll on individuals, families, hospitals, state and local governments, insurance providers, and society as a whole could be decreased through earlier detection and improvement in treatment outcomes. This makes prevention, early detection, effective treatment, and medical advances that minimize the impact of cancer a priority globally, nationally, and locally (CPRIT, 2015).

Experts in the field of cancer prevention and control and public health revised the TCP in 2012 and identified several priority initiatives with the belief that these evidence-based strategies could have a significant impact on the human and economic cancer burden in Texas. Priority initiatives in the TCP for 2012-2015 include increasing the screening and early detection for three specific cancers: breast, cervical, and colorectal cancer. These statewide initiatives are in alignment with the U.S. Department of Health and Human Services (2016) whose cancer objectives for Healthy People 2020 highlight the importance of monitoring the incidence of invasive cancer (cervical and colorectal) and late-stage breast cancer as markers of cancer screening success. Increasing risk-appropriate and timely screening services to detect pre-cancerous changes or cancers as early as possible for these cancer types allows treatment to be more successful (CPRIT, 2012). Indeed, the impact of additional screening initiatives for breast, cervical, and colorectal cancer could be far-reaching given the fact that the percentage of Americans

who have been screened for cancer remains below the national targets established by the Healthy People 2020 goal (U.S. Department of Health and Human Services, 2016).

Breast cancer is the most common cancer among women in the United States, but studies suggest that routine mammography screening can significantly reduce breast cancer mortality (ACS, 2014a). Cervical cancer is one of the most preventable and detectable cancers through regular screening (ACS, 2014b). Unfortunately, according to the most recent CDC survey, the percentage of women having a pap test within the past 3 years has declined when compared to previous years (CDC, 2013b). And, colorectal cancer is the third most commonly diagnosed cancer in men and women and the second leading cause of cancer death overall in Texas and the nation (Texas Department of State Health Services, 2014). Yet, fewer than 60% of individuals, between the ages of 50 and 75, report being up to date with colorectal cancer screening (CDC, 2013a). Therefore, "although it is evident to the public health community that screening for certain types of cancer in the general population can decrease incidence and mortality from the disease, adherence to screening recommendations within the population continues to be a challenge" (CPRIT, 2012, p. 9).

Conceptual Framework

Many researchers interested in cancer prevention are also interested in understanding both the determinants of health behavior and the process of health behavior change in order to develop effective strategies that might improve cancer preventive behaviors in the public domain (Noar & Zimmerman, 2005). Health Behavior Theory (HBT), derived from both the social, behavioral, and health sciences, has been used as the theoretical foundation for a multitude of health promotion interventions and

research. Its dominant paradigm is logical positivism, which emphasizes the use of induction as the source of knowledge and deduction as the standard for verification and confirmation of theory (Champion & Skinner, 2008). Researchers, in other words, begin with a hypothesis based on sensory experiences, feelings, or personal judgment as the source of knowledge, and test the theory through empirical methods or systematic observation (Glanz, Rimer, & Viswanath, 2008). However, concerns have been raised about the application and testing of HBTs and the level of stagnation that has prevented the field from moving forward (Glanz & Bishop, 2010; Noar & Zimmerman, 2005; Weinstein & Rothman, 2005). "The difficulty of reliably translating theory into interventions to improve clinical effectiveness has led to calls for more 'pragmatic trials' and increasing attention to the generalizability and translation of interventions into real-world clinical practice and community settings" (Glanz & Bishop, 2010, p. 406).

Understandably, effective health programs usually require behavior change at the individual, organizational, and community level and require an understanding of the contexts in which they occur (Glanz & Bishop, 2010). Although no single factor or set of factors can adequately determine the health behavior(s) an individual may or may not exhibit, a broad understanding of knowledge, attitudes, motivation, social relationships, socioeconomic status, culture, and other influences can help to provide the foundation for health promotion interventions (Glanz & Bishop, 2010). There are numerous HBTs and models that exist in current literature, including, the Health Belief Model (HBM), Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Social Cognitive Theory, (SCT), and Transtheoretical Model (TTM), as well as proponents of integrated theory that combines concepts from several existing theories (Noar & Zimmerman,

2005). While no single theory is dominant in health promotion and education, a recent review (1999-2005) of the most widely used theories in health behavior research revealed four distinct theoretical frameworks that were cited most frequently: TTM, TRA/TPB, SCT, and HBM (Glanz & Bishop, 2010; Weinstein, 1993).

Transtheoretical model. The Transtheoretical Model (TTM) is a theory of long-term changes in health behavior over time. The construct of stage of change or readiness to change is the key focus of the TTM and proposes that individuals are at different stages of readiness to adopt healthful behaviors. Its purpose is more aptly used to describe a sequence of non-linear steps in behavior change and the reason why individuals might not be ready to attempt the behavior change at all (Glanz & Bishop, 2010). Due to its emphasis on readiness to change over time, the TTM was not selected for evaluation in this research proposal. Instead, the Health Belief Model (HBM) and Social Cognitive Theory (SCT) were selected as more appropriate theoretical constructs for evaluating the precursors to enacting preventive health behaviors, such as cancer screening.

Theory of reasoned action/theory of planned behavior. The Theory of Reasoned Action and Theory of Planned Behavior (TRA/TPB) are used most often to understand, predict, and change human social behavior (Ajzen, 2012). According to the theory, intention precedes behavior. In general, individuals are more likely to do what they intend to do, not what they do not intend to do. Using the expectancy value framework postulating that an individual is more motivated to perform a behavior with a valued outcome, the TRA emphasizes two core variables that describe the strength of an intention: 1) expected value and 2) subjective norms. The TPB, added as an extension of

the TRA, further adds a self-efficacy belief known as perceived behavioral control (Perkins et al., 2007). The combined theory, TRA/TPB, thus stipulates that the intention to perform a behavior is a dual function of a favorable or unfavorable attitude toward the behavior, a subjective norm that encourages or discourages its performance, and degree of perceived behavioral control (Ajzen, 2012). The TRA/TPB is most commonly cited in studies evaluating predictive health behaviors or behavioral intentions (Weinstein, 1993), where successful performance of a behavior requires only the formation of intent (Armitage & Conner, 2000). Empirical comparisons of the TRA and HBM found both models to be similar in predicting health intentions with some studies favoring the HBM and others favoring the TRA (Armitage & Conner, 2000; Conner & Norman, 1994; Hill, Gardner, & Rassaby, 1985; Mullen, Hersey, & Iverson, 1987; Oliver & Berger, 1979). However, the TRA/TPB was not selected for the purposes of this research study due to the selection of the Health Belief Model (HBM) and Social Cognitive Theory (SCT) as a more judicious conceptual framework for studying actual cancer preventive behavior (i.e., cancer screening) versus intent.

Social cognitive theory. Social Cognitive Theory (SCT) surmises that individuals learn not only through their own experiences, but from the observational experiences of others (Bandura, 1961). In Bandura's (2004) own words, "human health is a social matter, not just an individual one" (Bandura, 2004, p. 143). This theory has experienced significant application in the healthcare field (Bandura, 1961) and has been cited for contributing to the success of health promotion intervention (Black, Marcoux, Stiller, Qu, & Gellish, 2012). The core determinants of SCT include knowledge of health risks and benefits of different health practices; perceived self-efficacy or the belief that

one can control one's own health habits; outcome expectations about perceived costs and benefits; health goals, including concrete plans and strategies; and perceived facilitators and impediments to change (Bandura, 2004). Self-efficacy is a central tenet in SCT and is considered by Bandura (2004) to be the foundation of human motivation and action. It shapes the outcomes expected by one's own efforts. In other words, regardless of the impediments, an individual has to believe they have the power to produce change. Additionally, perceived outcomes affect health behavior change by regulating the expectations of physical, social, and self-evaluative responses.

Health belief model. The Health Belief Model (HBM) was one of the first health behavior theories developed and is one of the most widely used conceptual frameworks that has supported change intervention in health behavior for the past 20 years (Champion & Skinner, 2008). Initially developed in the 1950s as an explanatory theory for the widespread failure of participation in programs to prevent and detect disease, it was later expanded to study people's responses to symptoms and adherence to medical regimens (Champion & Skinner, 2008). The theory hypothesizes that individuals are more likely to take action that they believe will reduce their risks if they regard themselves as susceptible to a condition, believe that condition has serious consequences, believe that a course of action would be beneficial, and believe that the anticipated benefits of taking action outweigh barriers to the action. Thus, key constructs in the HBM include perceived susceptibility (belief about the chances of experiencing a risk, condition, or disease), perceived severity (belief about the seriousness of a condition and its sequelae), perceived benefits (belief in the efficacy of an advised action to reduce risk or seriousness of impact), and perceived barriers (belief about the tangible and

psychological costs of an advised action) (Champion & Skinner, 2008). Measurements using HBM constructs have been developed for colorectal cancer screening behaviors, mammography, and breast self-examination (Champion & Skinner, 2008). In fact, the HBM has most often been applied to prevention related health concerns like early cancer detection (Austin, Ahmad, McNally, & Stewart, 2002; Gillam, 1991; Glanz & Bishop, 2010). However, these measurements have not been previously studied in the context of examining the personal cancer screening behaviors of oncology health care professionals.

Although the original HBM framework did not include self-efficacy or the confidence in one's ability to take action, its addition to the HBM was proposed by Rosenstock, Strecher, and Becker (1988) based on the importance of self-efficacy in the initiation and maintenance of behavioral change (Bandura, 1997; Champion & Skinner, 2008). It is the belief that in order for behavior change to succeed, an individual must feel competent (self-efficacious) to overcome perceived barriers to action (Champion & Skinner, 2008). As a result of mutual similarities, overlapping constructs from the SCT and the HBM are frequently noted in literature (Champion & Skinner, 2008; Weinstein & Rothman, 2005). Their intersection in the Champion Health Belief Model (CHBM) is the rationale for incorporating both theories into the conceptual framework for this research study.

Table 1

Comparison between SCT and HBM

Social Cognitive Theory (SCT)	Health Belief Model (HBM)
Expectancies about environmental cues	Perceived susceptibility to and severity of illness or its sequelae (threat)
Expectations about outcomes	Perceived benefits of taking a particular action minus perceived costs or barriers to action
Expectations about self-efficacy	Implied in perceived barriers
Incentive	Health motive: value of reduction of perceived threats

Note. Adapted from Rosenstock et al. (1988)

Cancer Screening Guidelines

The American Cancer Society (ACS) monitors medical and scientific literature as part of its ongoing guidelines development process and initiates a guideline update every five years, or sooner, based on new evidence. A summary of the ACS guidelines is published annually and is available online at no cost. This includes complete updates for breast, cervical, and colorectal cancers and a review of guidelines published by the U. S. Preventive Services Taskforce (Smith et al., 2016). The U. S. Preventive Services Taskforce is an independent, national panel of experts who collectively make evidence-based recommendations about clinical preventive services, including cancer screening, for dissemination to health care providers. Each guideline is graded based on the strength of evidence and a balance of benefits and harms and made available online and in peer-reviewed journals. An annual report is also submitted to the U. S. Congress for further examination (U. S. Preventive Services Taskforce, 2016). Although variations do exist at

the recommendation level for some cancers, published cancer screening guidelines from both organizations are consistent in their structure and inclusion of several knowledge components: population, assessment of risk, recommended screening tests and intervals, and a balance of benefits and harms. These guidelines follow the structural framework for guideline development by the National Academy of Medicine (formerly the Institute of Medicine) and are made available to oncology health care professionals for use in everyday practice. Knowledge is one of several modifying factors noted by the CHBM that may change health-related behavior by influencing the perception of susceptibility, severity, benefits, and barriers (Champion & Skinner, 2008).

Thus, the intent of this study was to explore the proposition that knowledge (i.e., understanding and familiarity) of cancer screening guidelines, mediated by health risk and benefit constructs from the CHBM, is associated with the personal cancer screening behaviors of oncology health care professionals (i.e., individuals in the health care profession who specialize in directly providing cancer treatment, services, or supportive care). In the context of oncology health care professionals, this research study conceptualizes that their heightened knowledge (i.e., understanding and familiarity) of cancer screening guidelines increases their perceived susceptibility to cancer, perceived severity of cancer, perceived benefit of screening for cancer, and their perceived self-efficacy or ability to take action against cancer, while decreasing their perception of barriers that would prevent them from getting screened for cancer, thereby increasing their adherence to cancer screening exams. The model shown in Figure 1 is reflective of this proposition.

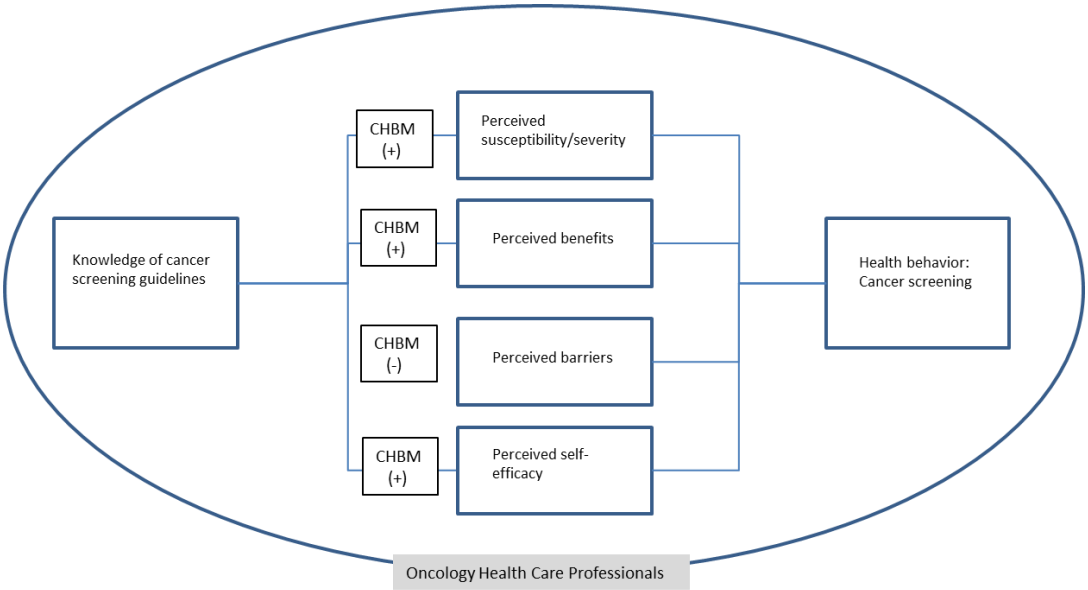

Figure 1. Proposed conceptual framework. Adapted from Health Belief Model Components and Linkages (Champion & Skinner, 2008, p. 49)

Statement of the Problem

Oncology health care professionals have a mandate from the Centers for Disease Control and Prevention (CDC) to promote evidence-based cancer screening guidelines and programs that reduce the cancer burden in the communities they serve (CDC, 2015). More specifically, Texas oncology health care professionals have a mandate from the Texas Cancer Plan (TCP) to "provide culturally relevant counseling, information, and referrals for cancer screening tests" and "adhere to guidelines and best practices for prevention, treatment, and supportive care" (TCP, 2012, p.7). Moreover, studies suggest that patients not only consider health care professionals to be reliable sources of health information, but health role models who play a key role in helping patients adopt screening and other prevention related practices (Abramson, Stein, Schaufele, Frates, & Rogan, 2000; Gurmankin, Baron, Hershey, & Ubel, 2002; Kreuter, Chheda, & Bull,

2009; Oberg & Frank, 2009; Villani & Mortensen, 2013). In fact, several studies demonstrate that health care professionals who practice healthy habits are more likely to influence patients to adopt healthy habits as well (Abramson, et al., 2000; Black et al., 2012; Frank, Breyan, & Elon, 2000; Frank, Dresner, Shani, & Vinker, 2013; Gross, Mead, Ford, & Klag, 2000; Hash, Munna, Vogel, & Bason, 2003; Lewis, Wells, & Ware, 1986; Livaudis, et al., 2005; Oberg & Frank, 2009). Thus, physicians occupy the dual role of teacher or counselor and the role of exemplar, or teaching by example. The consequences of failing to model preventive behavior may not only result in negative health consequences for clinicians, but in a credibility gap with the general public (Glanz, 1982). Although it is unknown if the personal cancer screening practices of oncology health care professionals may similarly influence the cancer screening practices of their patients, as community health advocates, it may be valuable to first examine the factors that influence the cancer screening behaviors of oncology health care professionals in general.

Purpose of the Study

The purpose of this quantitative, descriptive study was to examine the personal adherence of oncology health care professionals at a comprehensive cancer center to cancer screening guidelines for breast, cervical and colorectal cancers and the factors that influence their personal cancer screening decisions. Although several studies have evaluated the personal health behaviors of health care workers in general, (Frank et al., 1998; Chevan & Haskvitz, 2010; Lee, Gordon, & Whitman, 2015; Helfand & Mukamal, 2013), no research to date has focused exclusively on the personal cancer screening behaviors (i.e., personal adherence to cancer screening guidelines) of oncology health

care professionals. Yet, “healthcare workers (HCWs) represent an important group in which to study individual health behaviors, both because they are more knowledgeable than others about health care choices and because they serve as role models for patients” (Helfand & Mukamal, 2013, p. 242). Additionally, health care professionals generally have access to high quality medical care, as well as higher-than-average education and economic status, thereby eliminating factors that are known barriers in access to health care (McNerney, Andes, & Blackwell, 2007). Thus, findings from this study may fill a research gap about the personal cancer screening habits of oncology health care professionals, the factors that influence their cancer screening behaviors, and their role in advocating for cancer screening behaviors in the general population.

Research Question

The following research questions were intended to provide an answer to the personal cancer screening behaviors of oncology health care professionals and the factors that influence their cancer screening decisions: In what ways are the personal cancer screening behaviors of oncology health care professionals at a comprehensive cancer center consistent with the recommended cancer screening guidelines for cervical, breast, and colorectal cancers? To what extent does knowledge and mediating factors from the CHBM influence the personal cancer screening behaviors of oncology health care professionals?

Context for the Study

This survey of oncology health care professionals took place at a well-known comprehensive cancer center in a large city in the southwestern United States. It is one of the nation’s original three comprehensive cancer centers devoted exclusively to patient

care, research, education, and prevention for cancer patients. This comprehensive cancer center employs over 19,000 employees, including over 1,600 physicians, more than 700 advanced practice providers (i.e., physician assistants and advanced practice registered nurses), and approximately 3,000 nurses.

Significance of the Problem

According to Frank et al. (2013), patients whose physicians personally adhere to recommended screening practices are significantly more likely to also undergo screening compared with patients of noncompliant physicians. Additional studies support the premise that physician disclosure of personal health behaviors is highly influential on the health behaviors of their patients (Frank et al., 2000; Oberg & Frank, 2009; Wells, Lewis, Leake, & Ware, 1984). The rationale behind this level of influence is that physicians who model certain health behaviors are more likely to counsel their patients to do the same (Oberg & Frank, 2009). The significance of physician modeling in the cancer arena is of even greater value due to the health care crisis that cancer poses globally, nationally, and within the state of Texas. Screenings for breast, cervical, and colorectal cancer were identified in the 2012 TCP as priority areas for the implementation of strategies that will effectively reduce the burden of these cancers in the general population. Research shows that one third of cancer deaths could be prevented through screening tests, vaccinations, and lifestyle changes (CDC, 2016). All three of these cancers are considered to be preventable and treatable if detected early, thereby reducing the incidence and mortality for these types of cancers as well as the associated economic costs. Yet, general awareness and knowledge of cancer screening guidelines, alone, may not effectively explain the transformation of awareness into participation. Although notable

advancements and improvements in health have been made in areas like tobacco use, breast cancer screening, HIV/AIDS education, and others, the maintenance of health behavior change will be paramount in sustaining these gains and securing needed progress in other behavioral health areas (Brandt, Dolinger, Sharpe, Hardin, & Berger, 2012). Mediating factors, as proposed by the Champion Health Belief Model (CHBM), could play a significant role in predicting and implementing sustained health behavior change, even among oncology health care professionals. Effectively promoting personal adherence to cancer screening guidelines among oncology health care professionals by understanding the contributing factors that influence them to do so could prove to be an effective strategy in influencing patients and health care consumers in the general population to do the same.

Educational Value of the Study

This study was conducted to examine the ways in which the personal cancer screening health practices of oncology health care professionals at a comprehensive cancer center are consistent with nationally recommended cancer screening guidelines and explore the factors that influence their cancer screening behavior. The educational value of this study is significant because research already suggests that modeling of preventive health behaviors (i.e., disclosure of personal compliance with cancer screening guidelines) by health care workers may influence patients to adopt preventive health behaviors themselves (Black et al., 2012; Frank et al., 2000; Frank et al., 2013; Oberg & Frank, 2009; Wee, McCarthy, & Phillips, 2005; Wells et al., 1984). Therefore, personal adherence to cancer screening guidelines by oncology health care professionals could prove to be an effective preventive health care strategy in Texas, the nation, and the

world. Further, this study could help to validate existing health behavior theories and identify implementation strategies that, if incorporated into the TCP and other CDC cancer control plans, could play a key role in helping to reduce the cancer burden of breast, cervical and colorectal cancers in the general population. Additionally, this study could lead to further research within the cancer care community on the ability of health care institutions to foster effectual cancer prevention screening initiatives within their professional communities as well as in the general population.

Definition

1) ***Adherence* –** the extent to which a person's behavior (in terms of medications, following diets, or executing lifestyle changes) coincides with medical or health advice (Haynes, Taylor, & Sackett, 1979, p. 2)
2) ***Colorectal cancer* –** combined term used to describe cancer that starts in the colon or rectum. These cancers can be referred to separately as colon cancer or rectal cancer, but for statistical purposes are typically referred to collectively as colorectal cancer (ACS, 2015).
3) ***Knowledge of cancer screening guidelines*** – understanding of and familiarity with systematically developed statements that assist practitioner and patient decisions about appropriate health care for specific clinical circumstances (Field & Lohr, 1990, p. 8).
4) ***Oncology health care professionals* -** individuals in the health care profession who specialize in directly providing cancer treatment, services, or supportive care.
5) ***Perceived barrier* -** belief about the tangible and psychological costs of an advised action (Champion & Skinner, 2008).

6) ***Perceived benefit*** **-** belief in the efficacy of an advised action to reduce risk or seriousness of impact (Champion & Skinner, 2008).
7) ***Perceived severity*** **-** belief about the seriousness of a condition and its sequelae (Champion & Skinner, 2008).
8) ***Perceived susceptibility*** **-** belief about the chances of experiencing a risk, condition, or disease (Champion & Skinner, 2008).
9) ***Performance of cancer screening behavior(s)*** – performance or non-performance of cancer screening tests as defined by the American Cancer Society (ACS) or U. S. Preventive Services Taskforce (USPSTF) and as measured by the Behavioral Risk Factor Surveillance System (BRFSS).
10) ***Preventive health behavior*** **–** any activity undertaken by an individual who believes himself (or herself) to be healthy, for the purpose of preventing or detecting illness in an asymptomatic state (Champion & Skinner, 2008).
11) ***Self-efficacy*** **-** belief about the capability of performing a specific behavior in a particular situation (Strecher, DeVellis, Becker, & Rosenstock, 1986).

Limitations of the Study

Several limitations of this study should be considered. The context for this study was limited to a convenience sample at one comprehensive cancer center, which may not be reflective of oncology health care professionals nationwide. Additionally, the demographic make-up of oncology health care professionals at the study institution may not be reflective of the demographics within the broader community. Furthermore, the cross-sectional research design for this study was not useful in establishing causal relationships or changes in beliefs or behavior over time. This study may also have been

impacted by a sampling error caused by a lesser response from physicians as compared to other oncology health care professionals within the study institution due to the restrictions placed on contacting physicians directly through mass solicitation e-mail. Non-response from the wide variety of survey participants within the category of "oncology health care professional" may have impacted adequate representation of each group selected to reflect the study population. As expected, the questions that were administered by this study were limited to self-reported information, which cannot be externally validated. And, as with most self-report surveys, there was the potential for response and social desirability biases, or the tendency of respondents to answer questions in a manner that may be perceived favorably by others. Finally, since the survey was designed to be anonymous, the survey platform was not able to prevent survey participants from taking the survey more than once.

Summary

Comparisons between the personal cancer screening behaviors of oncology health care professionals and recommended cancer screening guidelines have not been previously studied, nor have the factors that may influence such personal decisions. Yet, research indicates that studying the personal cancer screening behaviors of oncology health care professionals may be beneficial in not only identifying the underlying motivators for their personal cancer screening decisions, but further evaluating whether their behavior may influence the cancer screening behaviors of their patients. Indeed, according to the research, health care professionals who model healthy behaviors may positively influence their patients to do the same (Frank et al., 2000; Frank et al., 2013; Oberg & Frank, 2009; Wells et al., 1984). Therefore, a review of the literature was

conducted to 1) examine the recommended guidelines for breast, cervical and colorectal cancer screenings and explore the construct of cancer screening knowledge in oncology health care professionals; 2) investigate health behavior constructs from the HBM and SCT and the overlapping concepts between both health behavior theories in the Champion Health Belief Model (CHBM); and 3) identify prior research evaluating the strength of relationships between each variable and possible gaps in the field.

Chapter II

Review of the Literature

Introduction

The purpose of this study was to assess the personal cancer screening practices of oncology health care professionals at a comprehensive cancer center by evaluating their knowledge of and behavioral adherence to recommended cancer screening guidelines for breast, cervical, and colorectal cancers and examining the theoretical constructs that may influence their personal cancer screening decisions. In order to thoroughly conduct this study, each construct from the proposed conceptual framework was reviewed. First, this literature review explored recommended cancer screening guidelines for breast, cervical, and colorectal cancers as well as the knowledge, awareness, and familiarity of physicians and other oncology health care professionals with such guidelines. Secondly, key constructs from the Health Belief Model (HBM) and Social Cognitive Theory (SCT) were analyzed in relation to personal health behaviors and decision-making. Thirdly, this review sought to clarify the strength of relationships between variables and identify key research studies in these areas.

Literature Search Strategy

The literature reviewed in this chapter contains primary and secondary sources retrieved from a variety of databases accessed through the research library of the academic institution where this research study was conducted. These scholarly databases included, MEDLINE with full text, PubMed Central with full text, and Elsevier with full text. Relevant keywords were combined in various ways to guide the search: *cancer, patients, cancer burden, cancer screening, screening guidelines, screening*

recommendations, cancer disparities, breast cancer screening, cervical cancer screening, colorectal cancer screening, cancer prevention, physician, nurse, health care professional, health habits, health influence, health compliance, health behavior, theory, model, comparisons, and social cognitive theory. Additional searches were conducted in Google Scholar and in various government health websites using the same keywords.

Cancer Statistics

According to the Centers for Disease Control and Prevention (CDC), more than twice as many people die globally from cancer than from AIDS, malaria, and tuberculosis combined (CDC, 2016). Furthermore, the World Health Organization (WHO) estimates that, without immediate action, the global number of deaths from cancer will increase 80% by the year 2030 (CDC, 2016). Annually, using data from the National Cancer Institute (Surveillance, Epidemiology, and End Results [SEER] Program), along with data from the Centers for Disease Control and Prevention (National Program of Cancer Registries); the North American Association of Central Cancer Registries; and the National Center for Health Statistics, the American Cancer Society (ACS) estimates the number of new cancer cases and deaths that will occur in the United States in the current year. The ACS then compiles data on cancer incidence, mortality, and survival from the previous year (Siegel, Miller, & Jemal, 2016). In its 2016 report, cancer is noted as “a major public health problem worldwide” and the “second leading cause of death in the United States” (Siegel et al., 2016, p. 1). In fact, cancer is the leading cause of death in 21 states (Siegel et al., 2016). In 2016 alone, the number of new cases of invasive cancer in the United States is expected to exceed 1.6 million, roughly equivalent to more than 4,600 new cancer diagnoses each day. It is also estimated that 595,690 Americans will

die from cancer in 2016, roughly equivalent to 1,600 deaths per day (Siegel et al., 2016). The ACS (2016) further estimates that the lifetime risk or probability that an individual will develop or die from cancer over the course of a lifetime in the United States is 42% in men and 38% in women. The significance of the incidence, survival, and practice patterns of current treatment for cancer can be reflected economically as well. Based on estimated expenditures of approximately $125 billion for cancer care in 2010, the National Cancer Institute (NCI) estimates an increase in base expenditures for cancer care to approximately $158 billion by the year 2020 (Mariotto, Yabroff, Shao, Feuer, & Brown, 2011). It can therefore be concluded that cancer poses a threat to the economic health and well-being of the United States as well as nations around the world.

It is widely believed, however, that a substantial proportion of cancers could be prevented, especially with a reduction in tobacco use and heavy alcohol consumption. "The World Cancer Research Fund estimates that about 20% of all cancers diagnosed in the US are related to body fatness, physical inactivity, excess alcohol consumption, and/or poor nutrition, and thus could also be prevented" (ACS, 2016a, p. 1). For this reason, cancer remains a disease in which human behavior and other societal factors play important causative roles (Hiatt & Rimer, 1999). Many other cancers could be avoided by preventing infections through behavioral changes or vaccination and by protecting skin from excessive sun or UV exposures (ACS, 2016a). Cancer screening also offers an opportunity to detect and remove some cancers early and is supported by research demonstrating a reduction in mortality for cancers of the breast, cervix, colon, and rectum (ACS, 2016a).

Cancer Disparities

Of even greater concern is the impact of cancer on the public and economic health of individuals of certain race, ethnicity, and socio-economic statuses and the disparity that exists in early cancer detection and prevention. “Socioeconomic and racial/ethnic disparities in health have been recognized and documented in the U.S. and the United Kingdom for decades” (O’Keefe, Meltzer, & Bethea, 2015, p. 1). The first Surgeon General’s Report on Health Promotion and Disease Prevention was published in 1979 and included recommendations for the periodic screening of major disorders, including certain cancers. While the first “Healthy People” report made note of national challenges to “becoming healthier people”, it recognized socioeconomic factors as potential restraints to progress and further stated that “the diversity of participants in prevention activities is both necessary and desirable” (U.S. Department of Health, Education, And Welfare, 1979, p. 11-7). Over the past two decades, the “Healthy People” report has continued to advocate for the reduction of health disparities among all Americans. Consequently, the Healthy People 2020 initiative clearly articulates its health disparities goal is to achieve health equity, eliminate disparities, and improve the health of all groups (U.S. Department of Health and Human Services, 2016). Yet, such disparities continue to exist (Singh et al., 2004). In a study commissioned by Congress and conducted by the Institute of Medicine (IoM) to “assess the extent of racial and ethnic differences in the quality of health care received by patients, not attributable to known factors such as access to care, ability to pay or insurance coverage” (Nelson, 2002, p. 666), the evidence overwhelmingly concluded that racial and ethnic disparities in health care exist even

when insurance status, income, age, and severity of conditions are comparable (Nelson, 2002).

In the United States, for example, Hispanics are less likely to be screened for breast, cervical, and colorectal cancers than non-Hispanics and screening rates are lower among Asians as compared with other groups (CDC, 2012). Additionally, the gap in breast cancer mortality between Black and White women increased notably between 2000 and 2010, which may be due to a more advanced stage at diagnosis and has been attributed to the lower frequency of mammograms, greater intervals of time between mammograms, and less consistent follow-up of suspicious mammogram results (O'Keefe, Meltzer, & Bethea 2015). Findings have also revealed potential racial disparities as they relate to physician recommendations for colorectal cancer screening (Coleman-Wallace, Baltrus, Wallace, Blumenthal, & Rust, 2013). These findings are supported by Coughlin and Thompson (2005) whose previous work revealed that African Americans, Hispanics, and American Indians/Alaska Natives who had visited a doctor in the past year were less likely to report receiving a recommendation for colorectal cancer screening than Whites. In fact, while colorectal cancer incidence rates, morbidity, and mortality have declined significantly over the past two decades, the colorectal cancer incidence and mortality rates for African- Americans have remained significantly higher than Whites. This finding therefore contributed to the American College of Gastroenterology's recommendation for African-Americans to begin colorectal cancer screening at 45 years of age, a full five years earlier than the age recommended by national colorectal cancer screening guidelines (Wirth et al., 2014).

Conversely, while Jerant, Fenton, and Franks (2008), confirmed that all minorities were significantly less likely to report up to date colorectal cancer screening, especially Asians and Hispanics, than non-Hispanic whites, their analysis also revealed other contributing factors that attenuated some of the race/ethnicity disparities such as income, health insurance, self-rated health, access to care, English speaking at home, and native birth in the continental United States. Hicks, Yap, Matthews, and Parham (2006) confirmed similar findings, specifically for cervical cancer noting that, "increasingly, socioeconomic status, education, age, and other comorbidities have been shown to be better predictors of cervical cancer screening and outcomes than race and ethnicity" (Hicks, Yap, Matthews, & Parham, 2006, p. 63). For instance, "lower socio-economic position is associated with receiving fewer Papanicolaou tests, mammograms, childhood and influenza immunizations, and diabetic eye examinations, later enrollment in prenatal care, and lower quality ambulatory and hospital care" (Fiscella, Franks, Gold, & Clancy, 2000, p. 2579). Arguably, failure to screen with a Pap test is often attributable to a lack of access to health care and is the most common related factor in the development of invasive cervical cancer (Hicks, Yap, Matthews, & Parham, 2006).

To summarize a review of the literature on cancer screening disparities, while most articles are in agreement that cancer screening disparities exist among minority groups, differences emerge when it comes to identifying the factors that contribute most to such disparities. Unfortunately, race, ethnicity, and socio-economic position are so closely intertwined that it can prove difficult to isolate these determining factors in disparities of health (Fiscella et al., 2000). As a result, the search for cancer screening disparities in Google Scholar revealed over 103,000 articles on the topic, with 6,950 of

them written in 2016 alone. And, although socioeconomic position appears to be the more powerful determinant of health care than race/ethnicity, both factors are associated with poorer health and shortened survival (Fiscella et al., 2000). As a result, cancer screening guidelines do not deviate based on race/ethnicity or socio-economic factors and remain the same for all in the U. S. population who are considered to be at average risk.

Knowledge of Cancer Screening Guidelines

In November of 1989, the U. S. Congress amended the Public Health Service Act and created the Agency for Health Care Policy and Research (AHCPR). As part of its emphasis on outcomes and effectiveness research, the AHCPR is responsible for the development, dissemination, and evaluation of practice guidelines under the Forum for Quality and Effectiveness in Health Care, reflecting congressional recognition of the need to translate knowledge into decisions that improve the nation's value for its health care spending (Field & Lohr, 1990). More specifically, the AHCPR was charged with the development and periodic review of 1) clinically relevant guidelines to assist physicians and health care practitioners in determining how diseases, disorders, and other health conditions can effectively and appropriately be prevented, diagnosed, treated and managed clinically and 2) standards of quality, performance measures, and medical review criteria for assessing or reviewing the provision of health care and assuring the quality of such care (Field & Lohr, 1990).

In coordination with the Institute of Medicine (IoM), the AHCPR defined relevant terms, specified the key attributes of good guidelines, and provided technical assistance on the planning, implementation, and evaluation of clinical practice guidelines. Clinical practice guidelines are defined as "systematically developed statements to assist

practitioner and patient decisions about appropriate health care for specific clinical circumstances" (Field & Lohr, 1990, p. 8). The intent of such guidelines is to decrease variation in clinical practice and consistently advance effective application in the field (Cabana et al., 1999). Eight attributes are considered essential if a set of guidelines are to serve their intended purpose. They should be valid, reliable and reproducible, clinically applicable, clinically flexible, clear and easy to follow, multi-disciplinary, regularly reviewed, and documented. Guidelines should be based on the best available research and professional judgment with clear justification and sensitivity to practical issues (Field & Lohr, 1990).

Clinical practice guidelines may be developed by public or private entities. Medical groups that have been involved in guideline development include the American Academy of Family Physicians, the American College of Cardiology, the American College of Physicians, the American Society of Anesthesiologists, individual specialty societies, the academic medical and health services research community, insurers, health maintenance organizations (HMOs), utilization management firms, and other such groups (Field & Lohr, 1990). One such specialty group, the American Society of Clinical Oncology (ASCO), is a global, professional network of over 40,000 oncology health care professionals and one of the leading resources for clinical oncology research and practice. ASCO develops and publishes clinical practice guidelines, provides guideline endorsements, and promotes evidence-based recommendations to serve as a guide for oncology health care professionals by outlining appropriate measures for treatment and care (American Society of Clinical Oncology [ASCO], 2016). Due to its primary focus on cancer treatment and survivorship, ASCO has not developed specific guidelines for

cancer screening. However, the society insists that oncologists have a critical opportunity to use risk assessment and cancer prevention strategies to interrupt the initiation of cancer and should position themselves to advise patients and be active in community based cancer prevention activities (Zon et al., 2009).

In 2002, ASCO demonstrated this commitment by establishing the standing Cancer Prevention Committee to ensure the integration of cancer prevention into practice and research. Although this committee does not offer risk assessments and prevention recommendations for specific cancers, it assumes that clinical oncologists offer preventive services in accordance with the ASCO curriculum on cancer prevention and other similar resources (Zon et al., 2009). The ASCO curriculum on cancer prevention was developed in response to a growing need to systematically educate medical students, residents, oncology trainees, and practicing physicians in cancer prevention. Included in the curriculum are strategies for integrating cancer prevention into practice, and more importantly, the interpretation and application of cancer screening guidelines. This includes education on how to judge the strength of evidence presented in numerous cancer prevention and early detection studies and incorporate these findings into standard practice (Zon et al., 2009).

Barriers that limit the effect of guidelines.

Yet, the results of some studies indicate a limited effect of guidelines on physician behavior. In particular, a systematic review of literature published between 1966 and 1998 abstracting barriers to physician adherence with clinical guidelines revealed seven general categories of barriers that could be grouped into three core areas of concern: physician knowledge, attitudes, and behavior. These barriers included lack of awareness,

lack of familiarity, lack of agreement, lack of self-efficacy, lack of outcome expectancy, inertia of previous practice, and external barriers (e.g., inconvenient, cumbersome, confusing, etc.). Though not specific to cancer screening guidelines, lack of awareness of U. S. Preventive Services guidelines was as high as 84%, more than 10% of physicians were not aware of the existence of 78% of the guidelines, and in all cases lack of familiarity was more common than lack of awareness (Cabana et al., 1999).

In subsequent research studies, lack of adherence to recommended guidelines has continued to elicit concern. In fact, lack of knowledge of clinical practice guidelines has been assessed in studies of physicians as a potential barrier to preventive cancer screening for patients. In one study published in 1986, the authors evaluated the factors determining practitioners' decisions to perform screening, including knowledge and attitudes. This review of general internal medicine faculty, residents, and nurse practitioners demonstrated cancer screening performance rates that were well below the ACS guidelines for all tests except Pap smear. Provider knowledge was highly variable and limited and reflected barriers related to patient discomfort, provider forgetfulness, lack of time, and provider inconvenience (McPhee, Richard, & Solkowitz, 1986). Similarly, the most frequently cited cancer screening barrier amongst a group of inner city physicians in New York was little physician training in prevention and unclear recommendations for preventive medicine (Ashford et al., 2000). In yet another notable study, while 49% of physician respondents confirmed the American Cancer Society (ACS) guidelines as very influential, and 28% cited the U. S. Preventive Services Taskforce (USPSTF) guidelines, the majority were not providing screening to all eligible patients in their practices (Klabunde et al., 2003). And, although one of the strongest

predictors of patient adherence to colorectal cancer screening is physician recommendation (Brawarsky, Brooks, Mucci, & Wood, 2004; Meissner, Potosky, & Convissor, 1992), lack of physician knowledge in colorectal cancer screening for high-risk and average risk patients has been noted in separate studies with particular concerns about its impact on underutilization in minority populations (Gennarelli et al., 2005; Klabunde et al., 2003; Schroy, Barrison, Ling, Wilson, & Geller, 2002). More impressively, these findings were supported by the results of a national survey of primary care physicians assessing their colorectal cancer screening and surveillance practices compared to three national experts and published guidelines. Over 400 respondents were asked about colorectal cancer screening tests for average risk and increased risk patients using hypothetical scenarios. Results indicated considerable variability in the frequency, appropriateness, and follow-up of performed tests pointing to the need for continuing education in the physician community (Sharma, Vasudeva, & Howden, 2000). Overall, though relatively few studies assessing physician knowledge or practice patterns in comparison to cancer screening guidelines were identified in a review of the literature, the studies that have been conducted indicate significant variability and point to the fact that a lack of knowledge in this area does exist (Applebaum, Ruhlen, Kronenberg, Hayes, & Peters, 2008; Ferrante, Winston, Chen, & de la Torre, 2008; Kirsner, Muhkerjee, & Federman, 1999). These findings are indicative of a need to conduct more research in this field.

At all stages of disease, however, effective health communication has been found to empower people to make informed health-related decisions and engage in health behaviors (Nelson et al., 2004). Changes in smoking behavior, for instance, resulted in an

estimated prevention of nearly 2.1 million smoking-related deaths between 1986 and 2000 (Nelson et al., 2004). And, after decades of health communication research, recipients of health communication messages have begun to adopt healthier lifestyles, including engagement in routine preventative screenings resulting in a noticeable impact on mortality rates from diseases like cancer (Hiatt & Rimer, 1999). An increased understanding of barriers to cancer screening has assisted with the development of effective strategies promoting adherence to breast and cervical cancer screening (Nelson et al., 1997). Traditional communication of cancer research findings to the general public has relied on passive diffusion strategies such as presentations to health care professionals, distribution of publications, and the use of conventional mass media (Nelson et al., 2004).

To summarize, oncology health care professionals are supported by a network of professionals in clinical oncology and an abundance of resources to evaluate and implement evidence-based recommendations for clinical practice. As a result of an enhanced understanding of cancer susceptibility and access to preventive strategies, oncologists in particular should have the knowledge and tools to inform their delivery of risk assessment and prevention services (Zon et al., 2009). In addition, their ability to advise patients and initiate cancer prevention activities should rely not only on their knowledge of risk assessment and prevention guidelines, but on their ability to judge the strength of evidence-based research and interpret recommended guidelines. “Oncologists also have the expertise to evaluate the strength of evidence for cancer prevention and early detection and integrate these findings into standard clinical practice” (Zon et al., 2009, p. 986). However, it is unclear, based on the lack of evidence, whether oncology

health care professionals similarly encounter knowledge, attitudinal, and behavioral barriers to guideline adherence as has been noted amongst primary care physicians and physicians in non-oncology fields. Two of the most well-known sources of cancer screening guidelines are the American Cancer Society (ACS) and the U. S. Preventive Services Taskforce (USPSTF). These two organizations are the most frequently cited entities for cancer screening guidelines and are presented in this literature review for breast, cervical, and colorectal cancer screening recommendations.

Breast cancer screening.

In 2016, it is estimated that invasive breast cancer will be diagnosed in over 245,000 women and roughly 2,600 men resulting in approximately 40,890 breast cancer deaths. In women, breast cancer is not only the most frequently diagnosed cancer but the second leading cause of cancer death (ACS, 2016a). Yet, from 2003 to 2012, breast cancer incidence rates remained stable in white women and only increased slightly in black women. In fact, from 1989 to 2012, breast cancer death rates declined by 36% due to improvements in early detection and treatment, which translates to the avoidance of approximately 249,000 breast cancer deaths (ACS, 2016a).

Surprisingly, breast cancer screening guidelines have been contentious, with increased scrutiny by panels of experts and clinical researchers over the last several years. Historically, breast cancer screening included a multi-modality approach for early detection consisting of breast self-examination, clinical breast examination, and screening mammography. However, two randomized clinical trials evaluating the specific role of breast self-examination in the early detection of breast cancer, called this particular practice into question by revealing no reduction in breast cancer mortality associated with

this practice (MacBride, Pruthi, & Bevers, 2012). Thus, a paradigm shift occurred, pushing recommendations away from breast “self-examination” to breast “awareness”, thereby promoting familiarity with breast changes instead of a specific self-examination technique. The idea of breast awareness was then incorporated into breast health education (MacBride et al., 2012).

As a consequence, published guidelines for breast cancer screening focus primarily on mammography and clinical examination. Recently updated guidelines from the ACS (2016a) recommend that women between the ages of 40 to 44 years of age with average risk of breast cancer be given a choice for annual mammography. Those 45 to 54 years of age should have an annual mammography, and those 55 years of age and older should have biennial or annual mammography as long as their overall health is good and life expectancy is 10 or more years. Conversely, evidence based research conducted by the USPSTF concluded that “mammography screening at any age is a tradeoff of a continuum of benefits and harms that varies on population and individual levels” (Nelson et al., 2016, p. 51). Therefore, their recommendations vary substantially from those of the ACS. For women between the ages of 40 to 49 years with average risk of breast cancer, the recommendation is to weigh the potential benefits and harms of screening mammography and begin biennial screening if the potential benefit has higher value. For women aged 50 to 74 years, biennial screening mammography is recommended. For women 75 years of age or older, the USPSTF believes current evidence is insufficient to assess the balance of benefits and harms, and therefore does not include specific recommendations for this age bracket in its published guidelines (U.S. Preventive Services Task Force [USPSTF], 2016).

As is evident, breast cancer screening guidelines from the ACS differ from those of the USPSTF based on the recommended age for initiating mammography screening, the relative frequency of this diagnostic test, and the upper age limit for discontinuing mammography exams. These differences can be attributed to disagreements in the evidence base for breast cancer screening research. This includes uncertainty regarding the extent of breast cancer mortality benefit coupled with uncertainty regarding the extent of harm (Carter et al., 2015). While most studies show mortality benefit for women aged 50 – 70 years, more recent studies suggest that benefit is lower than originally thought. As a result, the harm from false positive screening tests and the extent of over diagnosis are being more carefully scrutinized and have been instrumental in shaping guidelines and recommendations from both groups (Autier, Esserman, Flowers, & Houssami, 2012; Biesheuvel, Barratt, Howard, Houssami, & Irwig, 2007; Bretthauer & Kalager, 2013). In addition, the Society of Breast Imaging and the Breast Imaging Commission of the American College of Radiology have issued guidelines of their own. These guidelines are intended to supplement guidelines from the ACS, but oppose the recommendations of the USPSTF. The group recommends annual mammography screening starting at the age of 40 and ending when life expectancy is less than five to seven years on the basis of age or comorbid conditions (Lee et al., 2010). Of note, USPSTF recommendations have been met with widespread concern and criticism from the American College of Radiology, Society of Breast Imaging, ACS, National Cancer Institute, and other health care groups, resulting in ongoing disputes and lack of clarity on breast cancer screening for women (Dangi-Garamella, 2016; Haas et al., 2016; Wernli et al., 2016).

Cervical cancer screening.

The ACS estimates that approximately 12,990 cases of invasive cervical cancer will be diagnosed in 2016 and approximately 4,120 will die from this disease. It was once one of the most common causes of cancer death for women in the United States, but has decreased by more than 50% due to the increased use of the Papanicolaou (Pap) test. Although cervical pre-cancers are diagnosed more often than invasive cervical cancer, the risk of developing cervical cancer increases as a woman ages with more than 15% of cases found in women over 65 years of age (ACS, 2016b).

According to the ACS (2016b), all women should begin cervical cancer screening at age 21 by having a Pap test every three years until the age of 29. Yet, lack of Pap screening is the most common attributable factor to developing cervical cancer (ACS, 2016b). Studies of women enrolled in comprehensive health plans reported that up to 56% of those diagnosed with cervical cancer did not have a pap test within three years prior to their diagnosis (Hicks, Yap, Matthews, & Parham, 2006). Beginning at age 30, the ACS further recommends that a Pap test be combined with a Human Papilloma Virus (HPV) test every 5 years and should continue until the age of 65. Women of any age should not be screened every year with either screening method, unless abnormal screening results have been detected. Women may discontinue cervical cancer screening if they are over the age of 65 and have had regular screening over the past 10 years without any serious pre-cancerous results within the previous 20 years. Women may also discontinue screening if they have had a total hysterectomy, unless the hysterectomy was part of treatment for cervical pre-cancer (ACS, 2014b). The USPSTF recommendations are somewhat consistent with those from the ACS. Per USPSTF recommendations,

cervical cancer screening should be performed for women ages 21 to 65 years of age by having a Pap test every three years or a Pap test in combination with HPV testing once a woman is 30 years of age or older. HPV testing is not recommended for women younger than 30 years of age and no cervical cancer screening is recommended for women younger than 21. Women older than 65 years of age who have had adequate prior cervical cancer screening and are not otherwise at high risk as well as women who have had a hysterectomy with removal of the cervix and no history of a high-grade pre-cancerous lesion may discontinue screening for cervical cancer (Moyer, 2012).

To summarize, cervical cancer screening guidelines from the ACS and USPSTF are more congruent and imply consensus in the research community regarding the balance of benefits and harms. While there is evidence that most cervical lesions will not progress to cervical cancer and that the majority of treatment is overtreatment (Raffle, Alden, Quinn, Babb, & Brett, 2003), evidence supporting a reduction in morbidity and mortality from cervical cancer screening remains favorable (Bretthauer & Kalager, 2013). More recently, based on 2014 approval by the Food and Drug Administration of the HPV test, co-testing with both a Pap test and HPV test was added to consensus guidelines. Indications in the literature suggest that further research regarding the role of HPV testing as a primary modality may be explored (Felix et al., 2016; Ogilvie et al., 2016; Smith et al., 2016). Until those results are known, cervical cancer screening guidelines utilizing both testing methods remain consistent and supported by the literature.

Colorectal cancer screening.

"Colorectal cancer (CRC) is one of the most common and deadly types of cancer in the USA" (Wirth et al., 2014, p. 254). In 2016, it is estimated that there will be 134,490 diagnosed cases of colorectal cancer. It is currently the third most common cancer in both men and women. It is also the second leading cause of cancer death when both men and women are combined with an estimated 49,190 deaths expected to occur in 2016 (ACS, 2016a). According to the most recent data, there have been long term declines in colorectal cancer incidence rates since the mid-1980s, which has been attributed to changes in risk factors and the introduction of screening. Recently, more rapid declines in colorectal cancer incidence have been attributed to the increased utilization of screening colonoscopies, which prevent cancer by allowing precancerous lesions to be detected and removed during the procedure. By some estimates, the detection and removal of polyps during a colonoscopy may decrease colorectal cancer incidence by as much as 76%-90% (Levin et al., 2011; Winawar, Fischer, & Levin, 2016). For adults aged 50 to 75 years, colonoscopy use increased from 19% in 2000 to 55% in 2013. The success in this age group, however, is in contrast to the 1.8% per year increase in colorectal cancer incidence from 1992 through 2012 in men and women aged younger than 50 years, an age group not recommended for screening unless the individual is at more than average risk (Siegel et al., 2016). The reasons for this increase in young adults are currently unknown (ACS, 2016a).

The ACS (2016a) recommends colorectal cancer screening starting at the age of 50 for individuals who are at average risk. There are a number of recommended

screening options: (1) a guaiac based fecal occult blood test (gFOBT) with at least 50% sensitivity or fecal immunochemical test (FIT) with at least 50% sensitivity performed annually based on the manufacturer's recommendations for specimen collection; (2) a stool DNA test every three years; (3) a flexible sigmoidoscopy every five years or a flexible sigmoidoscopy every five years in combination with a gFOBT or FIT annually; (4) a double contrast barium enema every five years; (5) a colonoscopy every 10 years; or (6) a CT colonography every five years (ACS, 2016a). The USPSTF recommendations vary only slightly from those of the ACS. Although the USPSTF also recommends colorectal cancer screening for individuals with average risk starting at age 50 until 75 years of age, recommended strategies include: (1) a gFOBT or FIT annually; (2) a flexible sigmoidoscopy every five years; or (3) a colonoscopy every 10 years (USPSTF, 2016).

Therefore, in summary, differences in colorectal cancer screening guidelines between the ACS and USPSTF are primarily related to the utilization and frequency of diagnostic tools. Unlike other cancer screening guidelines, a variety of colorectal cancer screening options are available and are typically not presented in any preferred order. The US Multi-Society Task Force on Colorectal Cancer indicates that these screening tests could be grouped into two categories: 1) tests that primarily detect cancer and 2) tests that can detect cancer and advanced precursor lesions (Smith et al., 2016). The purpose of these two groupings is to support informed decision making regarding the advantages, limitations, and disadvantages that make these screening tests distinct. Options may be based on individual risk, personal preference, costs, or access to care (Smith et al., 2016). Overall, there is consensus that adherence to colorectal cancer screening starting at 50

years of age should be the most important facet of colorectal cancer screening programs (Ransohoff & Sox, 2016; Winawer et al., 2016).

Health Belief Model (HBM)

Chronic diseases, like cancer, are one of the most frequent causes of death in the United States and worldwide with behavioral factors like tobacco use, diet, and activity patterns prominently contributing to mortality. Positive behavior changes could contribute significantly to a reduction in mortality, suffering, and medical costs around the world. Interest in the application of effective health behavior interventions has seen a dramatic increase over the last several decades as governments re-commit resources to health education and promotion (Glanz, Rimer, & Viswanath, 2008). During the early 1950s, when the Health Belief Model (HBM) was being developed, social psychologists were constructing an approach to understanding behavior based on two learning theories. Stimulus response theorists like Watson and Skinner believed that learning was the result of reinforced events that reduce physiological drives and activate behavior (Hochbaum, Kegeles, Leventhal, & Rosenstock, 1974). On the other hand, cognitive theorists believed that behavior was a function of the subjective value of an outcome and the probability or expectation that a particular action will achieve that outcome. An additional precursor to the HBM was the early social-psychological work of Kurt Lewin, who conceptualized the individual existing in a life space composed of regions that were positively valued, negatively valued, or relatively neutral. Daily activities were envisioned as a pull between positive and negative forces (Hochbaum et al., 1974) where the value of an outcome and the estimate of the probability that a given action will result in that outcome determines an individual's behavior (Mikhail, 1981).This value expectancy theory concept was

gradually re-formulated in the context of health behavior theory in which a relationship was proposed between the value of avoiding an illness and the expectation that a specific health action may prevent that same illness (Champion & Skinner, 2008). In preventive medicine, this concept translates into the need for individuals to be persuaded that the future health reward is of greater value than the present state or the consequences of the present state (Berkanovic, 1976). Eventually, many of these expectancy concepts evolved into constructs incorporated into the HBM.

Health belief model (HBM) constructs.

In its earliest form, the HBM hypothesized that an individual would take action to avoid a disease if the individual 1) believed themselves to be personally susceptible to it, 2) believed that its occurrence would have at least a moderate severity on some aspect of their life, 3) believed that taking a particular action would be beneficial by reducing susceptibility or severity, and 4) would not require overcoming significant psychological barriers such as cost, convenience, pain, or embarrassment (Hochbaum et al., 1974). The HBM is thus a rational decision model that stakes its position on the belief that the likelihood of taking action is based on an individual's perceived susceptibility to an illness and perceived severity of that illness, which combined reflect the perceived threat of that illness, and an individual's perception of benefits and barriers related to the illness (Champion & Skinner, 2008). Although the HBM is evaluated holistically, each variable is independent of the other, and each has been shown to be more predictive of behavior depending upon the population and outcome measure being evaluated (Glanz et al., 2002).

Perceived susceptibility. Individuals may vary widely in their perception of susceptibility to a condition. This could vary from the perception of statistical possibility to a real feeling of increased risk or danger in contracting a condition (Hochbaum et al., 1974; Janz & Becker, 1984). Thus, perceived susceptibility is defined as one's belief about the chances of experiencing a risk, condition, or disease (Champion & Skinner, 2008). Perceived susceptibility has been found to be positively related to preventive health actions, including cancer screening. More than any other variable in the HBM, perceived susceptibility is supported most by empirical research (Janz & Becker, 1984; Mikhail, 1981).

Perceived severity. The degree of seriousness attributed to a health condition is also variable from person to person. It is typically judged by both the heightened degree of emotional response created by a condition as well as individual beliefs about the degree of difficulty a health condition may pose. This may include thoughts of death, disability, physical and mental functioning, or effects on social relations (Hochbaum et al., 1974; Janz & Becker, 1984). Perceived severity may be defined as one's belief about the seriousness of a condition and its sequelae (Champion & Skinner, 2008). Positive correlations have been found between conceptual perceptions of susceptibility and severity, which together comprise the construct of perceived threat (Haefner & Kirscht, 1970; Kirscht & Haefner, 1973; Mikhail, 1981).

Perceived benefit(s). The direction that a course of action takes as a result of an increased perception of susceptibility and severity (perceived threat) to a health condition is guided by an individual's belief in the availability of beneficial alternatives. The alternative, in this case, must reduce the perceived threat of an illness or unfavorable

health condition. Some literature even suggests that a delay in seeking diagnoses for cancer symptoms, for example, may illustrate a real conflict between a strong feeling of susceptibility to a serious disease and a conviction that there are no efficacious methods for prevention and control (Hochbaum et al., 1974). Perceived benefit is the belief in the efficacy of an advised action to reduce risk or seriousness of impact (Champion & Skinner, 2008). Research has continued to support the premise that individuals are more likely to comply with health recommendations when they believe the recommendations will reduce the perceived threat of the health condition (Mikhail, 1981).

Perceived barrier(s). Conversely, an action that is perceived as effective and beneficial in reducing the threat of a disease may also be perceived as inconvenient, costly, unpleasant, painful, or emotionally upsetting. Such barriers aggravate motives for avoidance (Hochbaum et al., 1974). They are beliefs about the tangible and psychological costs of an advised action (Champion & Skinner, 2008). The strength of this motivator can lead to various resolutions. For instance, if the readiness to act is high (i.e., perceived susceptibility, perceived severity, and perceived benefits) and the potential negative aspects (i.e., perceived barriers) are low, the action is likely to be taken. However, if the readiness to act is low and the potential negative aspects are high, an action is less likely to be taken (Hochbaum et al., 1974). Therefore, according to Becker and Maiman (1975), even if an individual is ready to act, beliefs about the probable effectiveness of an action and the difficulties engendered by that action will determine the likelihood of taking action. In fact, noncompliance is common when individuals doubt the safety of a regimen, believe it has adverse side effects, is complex, or even long in duration (Mikhail, 1981).

HBM research studies.

As one of the oldest and most researched health behavior theories, the HBM is frequently cited in health behavior implementation studies. In one of the seminal, ground-breaking studies related to the HBM, more than 1,200 participants were studied in an attempt to identify factors influencing their decision to obtain a chest x-ray for the detection of tuberculosis. Beliefs in susceptibility and the benefits of early detection were measured. According to the results, 82% of respondents who believed tuberculosis was both a real possibility and that one may have tuberculosis in the absence of symptoms, obtained at least one chest x-ray during the defined study period. Conversely, only 21% of the group exhibiting neither of these beliefs obtained a chest x-ray during the defined study period (Becker et al., 1977).

Another significant study, conducted by Kegeles (1963), examined the health behavioral conditions for preventive dental check-ups. The study was designed to measure perceived susceptibility to various dental diseases, perceived severity of these conditions, benefits about preventive action, and perceptions of barriers to those actions. The findings from this study likewise supported the HBM constructs being measured in which respondents who believed themselves to be highly susceptible, believed dental problems would be more serious, and believed dental visits to be more beneficial, made more preventive dental visits than those who did not. In a follow-up study conducted three years after the initial data collection, a prospective study was conducted to assess whether beliefs identified in the original study had longer term associations with behavior during the three year period. Although perceptions of seriousness and beliefs in benefits were no longer significantly related to subsequent behavior, the study found a correlation

between behavior and perception of susceptibility. 58% of those who had seen themselves as susceptible had made subsequent preventive dental visits, while 42% who had not accepted susceptibility made subsequent visits (Becker et al., 1977).

Further, in a meta-analysis of studies of the HBM conducted by Harrison, Mullen, and Green (1992), the authors sought to reassess the available evidence on the predictive ability of the HBM. For inclusion in the analysis, the authors first evaluated if the cause and effect variables in the specific population and setting were valid representations of the HBM constructs. Secondly, they determined if the methods were scientifically adequate to establish a reliable relationship and attribute causality. The review analyzed articles that measured four major dimensions from the HBM: susceptibility, severity, benefits, and costs (or barriers). Of the 16 studies that met criteria for inclusion, including reliability and validity measures, significant positive correlations were established between HBM dimensions and health behaviors. This confirmed the findings of previous work conducted by Janz and Becker (1984) whose comprehensive review identified perceived susceptibility as a strong contributor toward understanding preventive health behavior and found substantial empirical support for the HBM overall. Authors noted, however, that for the HBM to be validated as a model, weights and interaction terms should be developed demonstrating how the four dimensions work together (Harrison et al., 1992).

Multiple studies have continued to support an internal consistency with one or another of the HBM variables (Stein, Fox, Murata, & Morisky, 1992). Examples include studies in genetic testing for Tay-Sachs, participation in physical activity programs, public response to polio vaccinations, diabetes programs, breast cancer screening,

cervical cancer screening, and flu immunizations among others (Aho, 1979; Becker et al., 1977; Bloom –Cerkoney & Hart, 1980; Cummings, Jette, Brock, & Haefner, 1979; Fulton et al., 1991; Macrae et al., 1984). The HBM has demonstrated much of its success in secondary prevention research, like immunization and screening programs and appears to take on greater importance for periodic examinations than lifestyle changes (Codori, Petersen, Mighoretti, & Boyd, 1991; Fulton et al., 1991).

This is not to say, however, that all studies of HBM concepts have demonstrated positive correlations. In a 1963 study of 1,500 individuals analyzing beliefs, behavior, and subsequent behavior; perceived susceptibility, severity, and benefits did not account for significant variations in preventive and diagnostic behaviors (Becker et al., 1977). And, although the role of risk perception is critical to understanding the HBM and other health related behaviors, the strength of the relationships between the perception of risk, severity, and threat is not always clear. Since the HBM is a cognitive based model, it also does not consider the emotional component of behavior, where a negative emotion like fear may significantly influence behavior (Champion & Skinner, 2008). In addition to emotions, the HBM does not explicitly address social, interpersonal, or contextual issues (Brewer & Rimer, 2008). Furthermore, the inability to weigh key variables limits the predictive value of the HBM (Becker et al., 1977; Gillam, 1991; Weinstein, 1993). This limitation, however, is recognized in all of the main social cognition models for health behavior (Conner & Norman, 2005).

Social Cognitive Theory (SCT)

Social learning theories are similarly derived from value-expectancy views. First known as Social Learning Theory, Bandura's Social Cognitive Theory (SCT) posits that behavior is determined by expectancies and incentives. This includes expectancies about environmental cues, the consequences of one's own actions, and about one's own competence to perform the behavior needed to influence outcomes (i.e., self-efficacy), and it defines incentives as the value of a particular outcome, which could be health status, physical appearance, approval of others, economic gain, or other such consequences (Rosenstock et al., 1988). As a result, behavior change is a function of outcome expectations or beliefs about whether a given behavior will lead to given outcomes and efficacy expectations or beliefs about one's capability to perform the behavior that leads to those outcomes. In this context, self-efficacy is a belief about the capability of performing a specific behavior in a particular situation. It affects an individual's choice of behavioral setting, the amount of effort they will exert, and the length of time they will persist when faced with barriers or obstacles (Strecher et al., 1986). Efficacy expectations may vary in dimensions of magnitude, strength, and generality and therefore have important implications for performance. Magnitude, or the level of self-efficacy, refers to an individual's expected performance attainment. Self-efficacy strength is expressed by one's confidence in their ability to attain an expected level. Efficacy generality refers to the number of domains in which an individual feels efficacious (O'Leary, 1985). These expectations can also be weighted by the appraisal of efficacy information. For example, individuals may assign a higher relative weight to efficacy information obtained from a higher source of credibility. In this case,

information from a highly credible source will have a greater impact on efficacy expectations than information from a less credible source (Strecher et al., 1986).

"Belief in personal control over health matters has been employed in a number of studies as one of the measures of health motivation, and it has been positively correlated with compliance behavior" (Mikhail, 1981, p. 70). Even when other psychosocial constructs are included, "self-efficacy consistently emerges as a distinct and powerful predictor of behavior" (Strecher et al., 1986, p. 88). Bandura's research has suggested a two-step approach for evaluating and measuring self-efficacy: asking whether the individual believes whether a particular behavior can be accomplished and asking the individual to rate the strength of their belief for each designated task (Strecher et al., 1986). Although self-efficacy scales have been developed and utilized in various settings (Contento, Randell, & Basch, 2002; Maibach & Murphy, 1995; Moritz, Feltz, Fahrbach, & Mack, 2000; Sallis, Pinski, Grossman, Patterson, & Nader, 1988), further research may be required to understand adequate measurement and the underlying generalizations from one task related efficacy expectation to another (Maibach, & Murphy, 1995; Strecher et al., 1986).

SCT research studies.

Bandura (2004) argues that all aspects of behavior are influenced by perceived self-efficacy, and not all of them are health related. Thus, the SCT and self-efficacy, in particular, has not always received attention in health education research and practice literature (Brewer & Rimer, 2008; Strecher et al., 1986). However, strong associations between self-efficacy and general health practice areas such as smoking, weight control, contraceptive use, alcohol abuse, and exercise have been demonstrated (DiClemente,

Prochaska, & Gilbertini, 1985; Strecher et al., 1986; Weinberg, Hughes, Critelli, England, & Jackson, 1984). The relationship between self-efficacy and actual relapse has also occurred. For instance, studies have demonstrated the predictive power between self-efficacy and smoking where relapse was more likely to occur amongst participants in a lower self-efficacy cluster (O'Leary, 1985).

Most importantly, such studies have provided convincing support for the specificity value of this variable (Hofstetter, Sallis, & Hovell, 1990). It is found to be associated with behaviors so often that behavioral research may be considered incomplete if self-efficacy is not included (Brewer & Rimer, 2008). Bandura (1997) also proposed self-efficacy as a multi-dimensional phenomenon in relation to a number of specific public health behaviors. Testing by Hofstetter, Sallis, and Hovell (1990) supported this assertion and indicated that self-efficacy ratings are not uni-dimensional and are highly domain specific. In other words, self-reports of specific behaviors were highly related to self-efficacy ratings for that particular behavioral domain.

Relationship between the HBM and SCT

The self-efficacy framework of the SCT addresses both efficacy and outcome expectations, and outcome expectations are a major component of value-expectancy models of health behavior like the HBM. These expectations may significantly influence initial motivation and the decision to initiate or change a health practice (Strecher et al., 1986). Champion and Skinner (2008) have since promoted the idea that in order for behavior change to succeed, an individual must feel competent (self-efficacious) to overcome perceived barriers to action. Considerable overlap between the SCT and HBM has thus been noted in the literature (Maiman & Becker, 1974; Rosenstock et al., 1988;

Weinstein, 1993). This is because conceptual correlations seem to exist between the HBM concepts of perceived susceptibility and perceived severity and the SCTs concept of expectancies about environmental cues. In the SCT, there are three types of expectancies: situation-outcome, action-outcome, and perceived self-efficacy. The HBM's concept of perceived susceptibility, for instance, may represent one such situation-outcome expectancy (Conner & Norman, 2005). Perceived benefits in the HBM may also be grouped into outcome expectations from the SCT, and expectations about self-efficacy as proposed by the SCT may be implied in the grouping of perceived barriers within the HBM (Rosenstock et al., 1988). The self-efficacy construct, based on empirical research, appears to be a key predictor of health behavior, presenting a strong case for its inclusion in the HBM and other social cognition models of health behavior. Therefore, its addition to the HBM may in fact add to its predictive power (Conner & Norman, 2005).

Relationship between Knowledge and HBM/SCT Constructs

In the original HBM construct, structural variables like knowledge about the disease or prior contact with the disease, serve to condition individual perceptions as well as the perceived benefits of preventive actions. They may influence health motivations, threats, and perception of benefits, which may in turn motivate an individual to accept or undertake recommended behaviors including illness prevention in the absence of symptoms (Becker et al., 1977). Health literacy (i.e., knowledge), or a person's capacity to obtain, process, and communicate information about health is a modifiable factor that can affect an individual's ability to understand clinical and health-related information (Street & Epstein, 2008). And, according to Hochbaum et al. (1974), perceived

susceptibility and severity have a strong cognitive component partly dependent upon knowledge. Therefore, revised models of the HBM (CHBM) are reflected as below with knowledge included as a modifying factor that may influence individual beliefs.

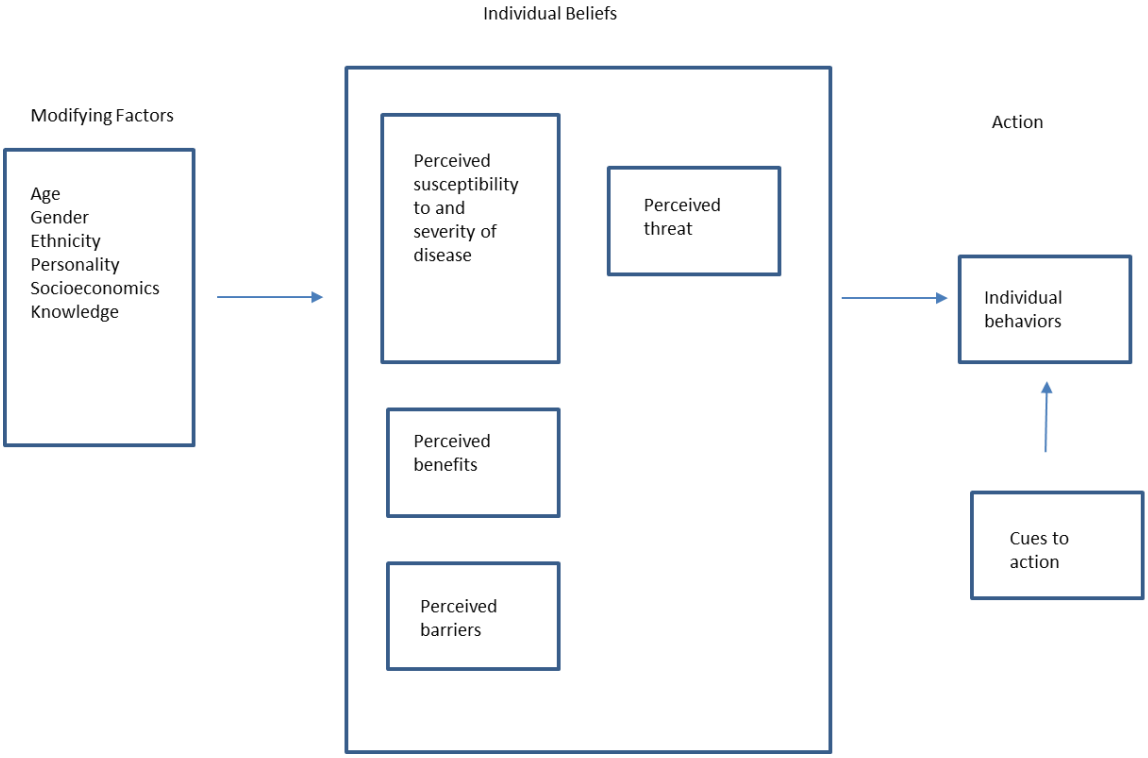

Figure 2. Health Belief Model Components and Linkages (Champion & Skinner, 2008, p. 49)

Knowledge is frequently used as a health behavior intervention in studies evaluating implementation of the HBM and SCT (CHBM) in community health practice. Additionally, various studies have been conducted to assess the impact of knowledge, self-efficacy, and perception of health behaviors. In one such study examining the impact of knowledge of cancer prevention behaviors, self-efficacy, and perceived importance on cancer prevention behaviors, data was collected at a public university through an online, anonymous survey. Perception of risk was also assessed. In the results, self-efficacy predicted cancer prevention behaviors similarly across all cancer types, whereas

knowledge significantly predicted some, but not all, cancer prevention behaviors. (Werk, Hill, & Graber, 2016).

Haefner and Kirscht (1970) attempted to use knowledge as a modifying factor by presenting individuals with communications about selected health problems. The intent of these messages was to use an increase in knowledge to influence an individual's perceived susceptibility and perceived severity regarding a health problem and increase beliefs in the efficacy of recommended behavior. It was determined that increasing the knowledge of individuals through the medium of health films significantly modified perceptions of susceptibility and benefits. Additionally, the results significantly indicated that more individuals exposed to the health film messaging communicated intent to obtain x-rays, make visits to a physician for a check-up, engage in regular exercise, and restrain from fatty foods. Upon follow-up, the experimental group had visited a physician for a check-up in the absence of symptoms significantly more often when compared to a control group not exposed to the messages. In summary, the study concluded it was possible to systematically modify individuals' beliefs concerning susceptibility and severity resulting in increased intentions to take pertinent health-related actions, leading to a positive demonstration of subsequent health actions (Haefner & Kirscht, 1970). Media health messaging was also the focus of a study in Poland to determine if health knowledge increased as a result of strategic health messaging through television and whether knowledge in turn impacted health behavior by way of HBM variables. The selected television programming differentiated facts from myths and suggested ways to improve health related behaviors (i.e., exercising, smoking cessation, reduced alcohol consumption, health eating). Results demonstrated statistically significant differences

between viewers and non-viewers for efficacy, susceptibility, seriousness, health knowledge, and health behavior. Ultimately, viewing the health programming increased health knowledge resulting in improved perceptions of efficacy, seriousness, susceptibility, lack of reliable information, and the practice of health behaviors (Chew, Palmer, Slonska, & Subbiah, 2002).

Knowledge has been identified as a modifying factor with significant relationships to HBM/SCT variables for a host of other studies. This includes men's knowledge about testicular cancer and the performance of testicular self-examination (Reno, 1988); nutritional knowledge, self-efficacy, and health eating (Gracey, Stanley, Burke, Corti, & Beilin, 1995); coronary heart disease and preventive behaviors in women (Ali, 2008); cervical cancer and pap smear screening (McFarland, 2003; Miok, 2000); hepatitis B prevention (Wang, Wang, & Tseng, 2009) and other such studies. No studies, however, were identified in which cancer screening knowledge, HBM variables, and self-efficacy were assessed in the context of oncology health care professionals.

Summary

This literature review guided the conceptual framework of this study by presenting a detailed assessment of cancer prevention and preventive screening guidelines for breast, cervical, and colorectal cancers as well as supportive literature about the cancer prevention and screening knowledge of oncology health care professionals. This chapter also focused its examination on researching the HBM and SCT (CHBM) constructs that may influence health behavior choices and presented an exploration of the relationship between variables from both constructs as well as the positive, negative, or neutral correlations found in existing literature. While the research

presented in this chapter highlighted significant findings in cancer prevention knowledge, cancer screening, cancer disparities, and health behavior theory, the results of this review revealed a gap in the literature does exist. To date, no studies have specifically examined the personal cancer screening behaviors of oncology health care professionals in comparison to national cancer screening guidelines, nor the influential factors associated with such behavior. Therefore, this was the first study to measure the CHBM constructs in this context. The following chapter outlines the research design and methodology selected to conduct a study exploring this gap.

Chapter III

Methodology

Introduction

The importance of screening for cervical, breast, and colorectal cancers is of global and national importance in the preventive health care arena. Examining the personal cancer screening behaviors of oncology health care professionals and their association with knowledge of established cancer screening guidelines and cancer screening beliefs may provide additional insight into the role of preventive behavior modeling and cancer screening advocacy by oncology health care professionals. Therefore, the aim of this study was to assess knowledge about cancer screening guidelines among oncology health care professionals at a comprehensive cancer center, their beliefs about cancer screening, and their personal adherence to cancer screening exams for cervical, breast, and colorectal cancers. This chapter includes a discussion of the research questions and corresponding hypotheses; variables and measures; study design and sampling; data collection procedures; and statistical analyses. The following research questions were intended to describe the personal cancer screening behaviors of oncology health care professionals and the factors that influence their cancer screening decisions.

Research Questions

1) In what ways are the personal cancer screening behaviors of oncology health care professionals at a comprehensive cancer center consistent with the recommended cancer screening guidelines for cervical, breast, and colorectal cancers?

$^{H1:}$ The personal cancer screening behaviors of oncology health care professionals at a comprehensive cancer center are consistent with the recommended cancer screening guidelines for cervical, breast, and colorectal cancers.

2) To what extent are knowledge and mediating factors from the CHBM (i.e., perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and perceived self-efficacy) associated with the personal cancer screening behaviors of oncology health care professionals?

^{H2}: Knowledge and mediating factors from the CHBM are associated with personal adherence to cancer screening guidelines in oncology health care professionals through a parallel mediation model.

Variables

The intent of this study was to explore the proposition that knowledge of cancer screening guidelines, mediated by perceived health risk and benefit constructs from the CHBM, is associated with the personal cancer screening behaviors of oncology health care professionals (i.e., individuals in the health care profession who specialize in directly providing cancer treatment, services, or supportive care). Therefore, in the context of oncology health care professionals, this research study conceptualized a parallel mediation model to explain the association between the independent, mediating, and outcome variables. The conceptual model, proposes that the heightened knowledge (i.e., awareness and understanding) of cancer screening guidelines increases one's perceived susceptibility to cancer, perceived severity of a cancer diagnosis, perceived benefit of

screening for cancer, and one's perceived ability to take action against cancer, while decreasing one's perception of cancer screening barriers, thereby increasing one's adherence to cancer screening exams. As such, knowledge of cancer screening guidelines is the antecedent variable within the conceptual framework, which was measured along with mediating variables from the CHBM, with the outcome variable being performance of cancer screening behaviors. The specific variables that were measured in this study, in addition to demographic variables, included the following:

Independent variable.

1) Knowledge of cancer screening guidelines for breast, cervical, and colorectal cancers

Mediating variables.

1) Perceived susceptibility;
2) Perceived severity;
3) Perceived benefits;
4) Perceived barriers;
5) Perceived self-efficacy

Dependent/outcome variables.

1) Performance of cancer screening behaviors (self-report)
    a. performance of mammography screening for breast cancer
    b. performance of Pap smear/HPV testing for cervical cancer
    c. performance of blood stool tests, sigmoidoscopy, or colonoscopy for colorectal cancer

Conceptual/Operational Definitions

a) ***Adherence –*** the extent to which a person's behavior (in terms of medications, following diets, or executing lifestyle changes) coincides with medical or health advice (Haynes et al., 1979, p. 2).

b) ***Colonoscopy*** – insertion of a long, flexible tube into the rectum to examine the colon for any unusual growths. The tube is longer than a sigmoidoscope and the procedure typically requires medication for relaxation or sedation (Rawl, Champion, Menon, Loehrer, Vance, & Skinner, 2001).

c) ***Blood test*** – a test that can be done at home to examine stool for hidden blood (includes fecal occult blood test [FOBT] and fecal immunochemical test [FIT]). The test requires placement of a small sample of stool or bowel movement on a special piece of cardboard, which is then sent to a physician's office or laboratory for testing (Rawl et al, 2001).

d) ***Flexible sigmoidoscopy*** – insertion of a long, flexible tube into the rectum to examine the colon for any unusual lumps or growths. The test usually does not require administration of medicine for relaxation or sedation (Rawl et al., 2001).

e) ***Knowledge of cancer screening guidelines*** – understanding of and familiarity with systematically developed statements that assist practitioner and patient decisions about appropriate health care for specific clinical circumstances (Field & Lohr, 1990, p. 8).

f) ***Oncology health care professional*** - individual in the health care profession who specializes in directly providing cancer treatment, services, or supportive care.

g) ***Perceived susceptibility*** - belief about the chances of experiencing a risk, condition, or disease (Champion & Skinner, 2008).

h) ***Perceived severity*** - belief about the seriousness of a condition and its sequelae (Champion & Skinner, 2008).

i) ***Perceived benefits*** - belief in the efficacy of an advised action to reduce risk or seriousness of impact (Champion & Skinner, 2008).

j) ***Perceived barriers*** - beliefs about the tangible and psychological costs of an advised action (Champion & Skinner, 2008).

k) ***Perceived self-efficacy*** - belief about the capability of performing a specific behavior in a particular situation.

l) ***Performance of cancer screening behavior(s)*** – performance or non-performance of cancer screening tests as defined by the American Cancer Society (ACS) or U. S. Preventive Services Taskforce (USPSTF) and as measured by the Behavioral Risk Factor Surveillance System (BRFSS).

Measures

Health information national trends survey (HINTS).

The Health Information National Trends Survey (HINTS) was developed by the National Cancer Institute (NCI) in 2001to gather information about the public's understanding of individual sources of and access to cancer-related information; perceived trust in sources and information received; knowledge about cancer and other health information; and factors that facilitate or hinder communication. Its purpose is not only to provide important insights into the health information needs and practices of the American public, but to provide health communication scientists with the opportunity to

conduct fundamental research into the basic relationships between cancer-related communication, knowledge, attitudes, and behavior (Nelson et al., 2004). Its development was based on the framework of Hiatt and Rimer (1999) identifying human behavior as a major determinant of cancer control while recognizing cancer-related behaviors as multifactorial in nature (Nelson et al., 2004). Administered every few years, the first HINTS survey was completed in 2003 with the initial and subsequent data sets made available to the public through the Department of Health and Human Services' data.gov. (Moser et al., 2013).

The most recent survey, collected in 2014, was the HINTS 4, Cycle 4 survey (National Cancer Institute, 2017). Although the HINTS survey includes questions about cancer knowledge, screening, and risks, the specific questions asked in each survey related to these topics has varied between surveys (HINTS 1 – HINTS FDA). Therefore, a search was conducted within the HINTS questions database to help identify questions pertaining to knowledge of cancer screening for breast, cervical, and colorectal cancers. The following search categories were selected: breast cancer, cancer perceptions and knowledge, cervical cancer, colon cancer, and risk perceptions. This search yielded a total of 297 items. Duplicate questions were frequently noted in the search results and were removed, yielding a total of 246 remaining questions. Questions were excluded if they did not pertain specifically to breast, cervical, or colorectal cancer screening (e.g., lung, prostate, skin, etc.). This eliminated a total of 161 questions, many of which also pertained to questions about the causation of cancer, lifestyle, future behavior or beliefs, cancer treatment, and general health. Another 31 items were similar to questions included in the Champion Health Belief Model instrument (described below) and the Behavioral

Risk Factor Surveillance Survey, which were adapted for this study. This excluded them for duplicative reasons. In addition, the 25 questions related to personal physician recommendations from HINTS were excluded, as were 15 open-ended questions. This resulted in a sample survey set of 14 questions. The final set of questions that were used to assess cancer screening knowledge are listed in Appendix A.

Champion health belief model (CHBM).

The Champion Health Belief Model (CHBM) instrument is a questionnaire that has been used to assess cancer screening behaviors using CHBM constructs. The original scales were developed through research conducted by Champion (1984) to measure perceived susceptibility to breast cancer, and perceived benefits and barriers to mammography utilization based on the respective HBM variables. The CHBM uses a summative 5-point Likert-type scale (1 = strongly disagree, 5 = strongly agree). The results of those studies yielded substantial evidence for the ability of the scales to reliably and validly measure HBM constructs (Champion, 1984). The scale underwent subsequent revision by Champion (1993, 1995, 1999) which re-validated certain components of the instrument and in some cases further reduced its length. Self-efficacy for breast cancer screening was also added to later versions of the scale (Champion, Skinner, & Menon, 2005). The seminal research by Champion (1984) resulted in scales that "can be used with substitution of a word or phrase to test the HBM using many different behaviors" (Champion, 1984, p. 85). Since that time, the CHBM has been re-validated for cervical cancer and Pap smear testing (Bish, Sutton, & Golombok, 2000; Guvenc, Akyuz, & Acikel, 2011) as well as colorectal cancer screening (Jacobs, 2002). The modified CHBM scales for each cancer screening type (i.e., breast, cervical, and colorectal) and the

corresponding CHBM scales and subscales that were used in this study are indicated in Appendix B.

Behavioral risk factor surveillance system (BRFSS).

The Behavioral Risk Factor Surveillance System (BRFSS) is recognized as the nation's premier system for collecting state data regarding health-related risk behaviors, chronic health conditions, and use of preventive services by U. S. residents. Cancer screening questions are part of the core content of the BRFSS questionnaire, a standard set of questions that all states use. Annual questionnaires dating back to 1984 are available to the public. Data is collected in all 50 states and three U. S. territories, making it the largest continuously conducted health survey system in the world (CDC, 2014). Currently, all states collect BRFSS data to help establish and track state and local health objectives and monitor trends. States use a standardized core questionnaire, optional modules, and state added questions. Many questions are taken from established national surveys, including the National Health Interview Survey or the National Health and Nutrition Examination Survey, allowing BRFSS to take advantage of questions that have been tested. All new questions must go through cognitive testing and field testing before they can become part of the questionnaire (CDC, 2015). Numerous studies have been conducted to examine the reliability and validity of the BRFSS, including the reliability and validity of prevalence estimates (Pierannunzi, Hu, & Balluz, 2013; Li, Balluz, Ford, Okoro, Zhao, & Pierannunzi, 2012); the validity of multiple modes of data integration (Hu, Pierannunzi, & Balluz, 2011); the reliability and validity of response rates (Fahimi, Link, Schwartz, Levy, & Mokdad, 2008), and the validity of national estimates (Nelson, Powell-Griner, Town, & Kovar, 2003). In general, data and material produced by federal

agencies are in the public domain and may be reproduced without permission, however published material derived from the data should acknowledge the CDC's BRFSS as the original source (CDC, 2015). The BRFSS questions that were used in this research study are listed in Appendix C. The combined, full-length survey that was used for this study is listed in Appendix D. To summarize, Table 2 depicts each study variable, its corresponding measurement scale, and its description in relation to the research question(s).

Table 2

Measurement of Study Variables

Variable	Measurement Scale	Research Question
Independent: Knowledge of cancer screening guidelines for breast, cervical, and colorectal cancers	Health Information National Trends Survey (HINTS)	Research Question 2
Mediating: Perceived susceptibility	Champion Health Belief Model (CHBM)	Research Question 2
Mediating: Perceived severity	CHBM	Research Question 2
Mediating: Perceived benefits	CHBM	Research Question 2
Mediating: Perceived barriers	CHBM	Research Question 2
Mediating: Perceived self-efficacy	CHBM	Research Question 2
Dependent: Performance of mammography screening for breast cancer	Behavioral Risk Factor Surveillance Survey (BRFSS)	Research Question 1

(continued)

Variable	Measurement Scale	Research Question
Dependent: Performance of Pap smear/HPV testing for cervical cancer	BFFSS	Research Question 1
Dependent: Performance of blood stool tests, sigmoidoscopy, or colonoscopy for colorectal cancer	BRFSS	Research Question 1

Study Design and Sampling

This study used a cross-sectional, self-administered survey design and a convenience sample of oncology health care professionals at a well-known comprehensive cancer center in a large city in the southwestern United States. Cross-sectional surveys are frequently used to provide a snapshot of a population at a single point in time and collect self-reported data on topics such as opinions, attitudes, beliefs, and values, which was in keeping with the intent of this research study. Institutional Review Board (IRB) approvals were obtained from the University of Houston and the comprehensive cancer center where the study took place, respectively. The IRB for the study institution served as the primary IRB of record (IRB # PA17-1033).

Participants

Eligible participants were 21 years of age or older and employed as an oncology health care professional at the study institution during the study duration period. Per the study institution, the definition of oncology health care professional was consistent with the definition employed in this study and included, but was not limited to: physicians (including residents and fellows), registered nurses, advanced practice registered nurses, physician assistants, psychologists, physical therapists, occupational therapists,

pharmacists, respiratory therapists, dieticians, technicians, social workers, chaplains, and nursing assistants. In an effort to capture participants at average risk for the three cancer types addressed in this study, research participants were excluded from answering questions about cervical, breast, or colorectal cancer screening beliefs or behaviors if they had received a prior diagnosis of or treatment for cervical, breast, or colorectal cancer, respectively. The rationale for exclusion was because a diagnosis of cervical, breast, or colorectal cancer places individuals at higher risk than the average population. The data collected did not require the name or exact title of any study participant and was submitted anonymously through use of an electronic survey platform, Research Electronic Data Capture (REDCap).

Eligibility

The following eligibility variables were collected for this research study:

Inclusion.

1) Age range (greater than or equal to 21 years)

2) Oncology health care profession/role (as defined by the study)

3) Years of service at the study institution (must be employed at the study institution during the study period)

4) Gender (must identify as male or female for appropriate stratification)

Exclusion.

5) Prior diagnosis of or treatment for cervical cancer (only excluded from survey questions about cervical cancer screening beliefs or behaviors)

6) Prior diagnosis of or treatment for breast cancer (only excluded from survey questions about breast cancer screening beliefs or behaviors)

7) Prior diagnosis of or treatment for colorectal cancer (only excluded from survey questions about colorectal cancer screening beliefs or behaviors)

Demographics

The following demographic variables were collected for this research study:

1) Race/Ethnicity
2) Immediate family history (1st degree relative) of cervical, breast, or colorectal cancer

Research Strategy

Recognizing the lower response rate to web and e-mail surveys as compared to postal surveys and the survey saturation of healthcare professionals who are regularly asked to complete questionnaires in many aspects of their professional roles (McPeake, Bateson, & O'Neill, 2014), the tailored design approach described here was intended to reduce total survey error to an acceptable level and motivate participants to respond within resource and time constraints (Dillman, Smyth, & Christian, 2014). Although a single-mode approach was selected for this study, the advantages of e-mail surveys include the possibility of rapid surveying, especially for large samples, and cost savings associated with postage, printing, and interviewer costs (Schaefer & Dillman, 1998). According to de Leeuw, Hox, and Dillman (2008), the administration of web surveys simply requires that a valid e-mail address is available and that the recipient is motivated to open the invitation e-mail and read it. The use of valid e-mail distribution groups (i.e. listservs) approved by the study institution was intended to minimize the non-response rate associated with invalid e-mail addresses since employer- based e-mail addresses and web accessibility are given to all employees, including oncology health care

professionals, at the study institution. Implementation of an electronic survey with a three week completion time window was intended to allow participants the flexibility to participate when it was most convenient for them to do so.

To minimize refusals related to motivation, de Leeuw et al. (2008) suggest that the researcher emphasize the benefits of taking part, de-emphasize any drawbacks such as the amount of time it will take, and address any potential concerns (de Leeuw et al., 2008). As such, efforts were taken to clearly identify the purpose of the study; limit questions to only those that were necessary using existing, validated surveys; remove any open-ended questions; and specify the approximated length of time (no more than 30 minutes) required to complete the survey. Finally, validation of the survey's legitimacy was enhanced by the use of an internal e-mail address from the researcher and a familiar, web-based survey platform supported by the study institution as the approved platform to capture data for research studies. Further discussion about the REDCap system is discussed in the section, Data Collection Procedures: Data Repository.

Data Collection Procedures

The survey period was initially opened for a duration of three weeks (March 1, 2018 – March 22, 2018). Due to the spring break week that occurred in the middle of the survey period and the lower than expected response rate, the survey was re-opened for an additional week (March 29, 2018 – April 8, 2018). In each case, once the survey was initially opened for enrollment, eligible participants (i.e., participants identified as belonging to the definition of oncology health care professional at the study institution) received a solicitation e-mail using department based e-mail distribution groups (i.e. listservs) from the principal investigator requesting their participation in an evaluation of

cancer screening knowledge, personal cancer screening beliefs, and cancer screening behaviors (Appendix E). A link to the survey was embedded in the initial solicitation e-mail. Due to institutional restrictions on mass e-mail solicitations to the clinical faculty (i.e., physician) listserv directly, the initial solicitation e-mail for physicians was sent to faculty department chairs during the first survey period requesting their participation in forwarding the e-mailed survey to physicians in their respective departments. During the second survey period, the solicitation e-mail was re-sent to eligible non-physician participants as well as individual physicians based on published departmental rosters in an effort to solicit more physician participation. A link to the electronic survey was again embedded in the second solicitation e-mail. No compensation was offered to participants who agreed to take part in this research study.

Additional evidence supports the assertion that the most powerful determinant of response rates is the number of attempts made to contact eligible survey participants. Multiple contacts should increase response rates and are greatest when there are three or more attempts to contact eligible participants (Dillman et al., 2014; Schaefer & Dillman, 1998). In alignment with this concept, the initial solicitation e-mail was followed by a reminder e-mail during the 2nd and 3rd weeks of the first survey period (Appendices F and G, respectively). The reminders were intentionally spaced at least a week apart with each reminder varied in content to appeal in different ways to the respondents to further increase response rates (Dillman et al., 2014). During the second survey period, an e-mail was sent to eligible survey participants informing them that the survey had been re-opened for final enrollment (Appendix H). Each follow-u p e-mail included a link to the electronic survey.

Data collection survey methods.

What follows is an explanation of the methods that were used to gather and analyze the data generated by this research study. The “Cancer Screening Knowledge, Perceptions, and Behavior” survey was systematically designed using 11 survey sections: 1) Introduction; 2) Informed Consent; 3) Eligibility; 4) Demographics; 5) Knowledge About Cancer Screening Guidelines; 6) Cervical Cancer Screening Beliefs; 7) Cervical Cancer Screening Behaviors; 8) Breast Cancer Screening Beliefs; 9) Breast Cancer Screening Behaviors; 10) Colorectal Cancer Screening Beliefs; 11) Colorectal Cancer Screening Behaviors.. The initial solicitation e-mail to all eligible participants (Appendix E) included the purpose of the study and its primary aim, eligibility criteria, an estimate of the time it would take to complete the survey (no more than 30 minutes), a statement of anonymity and the voluntary nature of the study, the name of the researcher with contact information, disclosure of review board approval, and doctoral dissertation affiliation. Access to the web-based survey, “Cancer Screening Knowledge, Perceptions, and Behavior”, was embedded as a link within the body of the solicitation e-mail.

In the introductory survey section, participants were provided with a summary of the research in accordance with the University of Houston Committee for the Protection of Human Subjects. After review, participants proceeded with the survey based on the information provided by clicking “submit”. The introductory survey section was followed by an informed consent and questionnaire statement requiring electronic consent to take part in the study as approved by the IRB of the study institution. Access to all remaining survey sections could not be obtained without consenting to take part in the research study.

Consent to take part in the research study was immediately followed by eligibility screening questions. If eligibility was not established, individuals were informed that they were not eligible for the study, but thanked for their consideration. Ineligible participants were unable to access any remaining survey sections. If eligibility was established, all participants had the opportunity to respond to demographic questions and the knowledge about cancer screening guidelines section of the survey. Utilizing branching logic in the REDCap system further enabled the use of stratification based on responses to eligibility questions (i.e., age range, gender, prior diagnosis of or treatment for cervical, breast, or colorectal cancer), which triggered participants' access to the survey sections for cervical cancer screening beliefs and cervical cancer screening behaviors; breast cancer screening beliefs and breast cancer screening behaviors; and colorectal cancer screening beliefs and colorectal cancer screening behaviors, respectively. At the conclusion of the final survey section for which each participant was eligible, participants were thanked for taking the time to complete the survey. The value of their anonymous responses was reiterated, and participants were reminded of the name and contact information of the principal investigator. A summary of the questions stratified by respondent characteristics is listed in Table 3.

Table 3

Survey Items Stratified by Age and Gender

	Men		Women		
Age	21-49	50+	21-39	40-49	50+
			Instrument		
HINTS	14 items	14 items	14 items	14 items	14 items
CHBM	NA	39 items for colorectal cancer screening beliefs	39 items for cervical cancer screening beliefs	39 items each for cervical and breast cancer screening beliefs	39 items each for cervical, breast, and colorectal cancer screening beliefs
BRFSS	NA	Up to 5 items on colorectal cancer screening behaviors	Up to 5 items on cervical cancer screening behaviors	Up to 5 items on cervical and up to 2 items on breast cancer screening behaviors	Up to 5 items on cervical, up to 2 items on breast, and up to 5 items on colorectal cancer screening behaviors
Total potential items	14	58	58	99	143

Ethical considerations.

While there could be potential for distress related to survey participation addressing cancer screening, it was not anticipated that this or other risks, discomforts, hazards, or inconveniences to the subjects would be experienced as it relates to the subjects' participation in the research. As such, this study involved less than minimal risk to study participants. No personally identifiable information was collected from study participants. All responses were anonymous. Participants could refuse to answer any (or

all) of the questions by skipping them or selecting “prefer not to answer”. By answering the questions, participants acknowledged that they were providing authorization for the use of their responses for stated study purposes. As such, participation was voluntary and respondents could refuse to participate or exit the survey at any time without penalty. Participants could also opt to return to their study by using an auto-generated return code. Even though there was no direct benefit to individuals participating in the study, what is learned from this study has the potential to benefit employees at the study institution through future enhancement and support of cancer screening and wellness programs.

Sample size calculation.

Only oncology health care professionals at the study institution were eligible to complete the electronic survey. Based on the most recent data obtained from the Human Resources department at the study institution, there were approximately 19,896 total employees at the institution. Approximately 78% of the total workforce would be eligible, based on age (21 years or older), to complete the survey resulting in an initial pool of 15,489 employees. An approximation of the total number of employees eligible to complete the survey based on their job title as an oncology health care professional, however, was 5,500. This included, but was not limited to, 1,315 physicians; 2,480 nurses; 46 social workers; 31 case managers; 800 advanced practice providers; 135 pharmacists; 41 respiratory therapists; and 24 physical and occupational therapists. Sample size estimates were based on the precision of estimating adherence to screening guidelines. Using an approximate pool of 5,500 oncology health care professionals, it was estimated based on age and gender that approximately 2,700; 1,600; and 1,200 participants would be eligible to meet the screening criteria guidelines for cervical,

breast, and colorectal cancers respectively. Assuming a response rate of 25%, it was anticipated that 300 respondents per screening category (i.e., cervical, breast, and colorectal) would respond to the survey. Given that women age 50 years and older would be eligible to answer the questions in all of the survey instruments, the minimum sample size was calculated to be 300 participants up to the full potential of 5,500 eligible individuals.

When the sample size is 300, a two-sided 95% confidence interval for a single proportion using the large sample normal approximation would extend 0.055 from the observed proportion for an expected proportion of 0.60 (the estimate for individuals being up to date with colorectal cancer screening [CDC, 2013]). Also, for example, a logistic regression of a screening behavior on an HBM factor (continuous) with a sample size of 300 observations achieves 80% power at a 0.05 significance level to detect a change in probability of adherence (prob Adherence = Yes) from the value of 0.60 at the mean of HBM to 0.676 when HBM is increased to one standard deviation above the mean. This change corresponds with an odds ratio of 1.391. NQuery Advisor v.7.0 and NCSS PASS 2005 were used for sample size justification.

Table 4

Sample Size Estimates

N	P0 (Baseline Prob Screening = Yes)	P1 (Alt Prob Screening = Yes)	OR
50	0.5	0.688	2.209
100	0.5	0.637	1.751
200	0.5	0.598	1.486
300	0.5	0.58	1.382
400	0.5	0.57	1.323
450	0.5	0.566	1.302
50	0.6	0.771	2.245
100	0.6	0.727	1.772
200	0.6	0.692	1.498
300	0.6	0.676	1.391
400	0.6	0.666	1.331
450	0.6	0.663	1.309
50	0.7	0.847	2.374
100	0.7	0.811	1.843
200	0.7	0.782	1.541
300	0.7	0.769	1.423
400	0.7	0.76	1.358
450	0.7	0.757	1.334
50	0.8	0.915	2.693
100	0.8	0.89	2.015
200	0.8	0.868	1.641
300	0.8	0.857	1.498
400	0.8	0.85	1.419
450	0.8	0.848	1.391

Statistical analysis.

The primary objective was to estimate the personal adherence to cancer screening guidelines of oncology health care professionals at a comprehensive cancer center and their consistency with the recommended cancer screening guidelines for cervical, breast, and colorectal cancers. The secondary objectives were to estimate respondents' knowledge of cancer screening guidelines, perceived susceptibility to cancer, perceived severity of a cancer diagnosis perception of benefits of cancer screening; perceived

barriers to cancer screening; and the perception about one's ability (self-efficacy) to be screened. Secondary objectives also evaluated associations between knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and perceived self-efficacy with adherence to screening guidelines for cervical, breast, and colorectal cancers.

The demographic characteristics of the study populations were summarized with means, standard deviations, ranges for continuous variables, and frequencies and percentages for categorical variables. CHBM statistics were summarized separately by screening method due to the various guidelines and populations of interest for each screening method. The proportion of those adherent to screening guidelines were calculated along with 95% confidence intervals. Similar estimates were calculated for knowledge, perceived susceptibility, perceived severity, perception of benefits, perception of barriers, and perception of ability to be screened (CHBM).

Mediation analysis, using the methods of Baron and Kenny (1986) with a three-step regression sequence. Notably, other CHBM studies have used regression analysis to analyze associations with adherence (Lambert, Chandler, McMillan, Kromrey, Johnson-Mallard, & Kurtyka, 2015; Lo, Chair, & Lee, 2015). Three regression models were used for this analysis, similar to the mediation analysis proposed by Baron and Kenny (1986): (1) independent (knowledge) to dependent variable (adherence); (2) independent (knowledge) to mediating variables (CHBM); and (3) independent (knowledge) plus mediating variables (CHBM) to dependent variable (adherence). An additional regression analysis was conducted between the mediating (CHBM) variables alone to the dependent

variable (adherence) to determine if a direct relationship existed between the CHBM and adherence.

To explore associations between knowledge and the CHBM constructs, linear regression models were conducted with knowledge as the covariate and CHBM as the outcome. Linear regression is a linear approach that can be used to model the relationship between a scalar dependent variable and one or more explanatory variables. It is frequently used to study the relationship between two continuous quantitative variables. It is also used when the outcome can have an infinite number of possible values.

To explore associations between knowledge and the CHBM constructs with adherence, logistic regression models were conducted with knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and perceived self-efficacy (CHBM) as covariates in the model and adherence to cancer screening guidelines as the outcome (BRFSS). Logistic regression models can be used for predictive analysis when there is an independent variable that determines an outcome and the outcome variable has only a limited number of possible values. It is typically an appropriate analysis to conduct when the dependent variable is dichotomous. In this case, the outcome variable is adherence or non-adherence. Similar models were conducted to assess demographic variables and adherence. All statistical analyses were performed using Stata/MP v15.0 (College Station, TX).

Data repository.

Study data was anonymously collected and managed using REDCap hosted at the study institution. REDCap is a secure, web-based application with controlled access designed to support data capture for research studies, providing: 1) an intuitive interface

for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless downloads to common statistical packages; and 4) procedures for importing data from external sources (Harris et al., 2009). REDCap is hosted on a secure server in the Department of Research Information Systems & Technology Services at the study institution utilizing user authentication and is subject to institutional policy governing the use and protection of information resources. This system has undergone an annual governance risk and compliance assessment (since May 2014) and was found to be compliant with the Health Insurance Portability and Accountability Act (HIPAA) and other state and federal regulations. The application is deployed on a RedHat Linux server, backed up nightly, with well-defined processes for disaster recovery.

Any secure computing device at the study institution could be used to access the survey, however, no identifiable data was stored. Only the principal investigator (PI) and members of the research team (i.e., research advisor and biostatistician) had access to the data. Data exported for analysis was stored on a secure shared drive (Box and REDCap) accessible only to the PI and research team at the study institution. Since study data may be useful as baseline data for future research studies performed under separate IRB approved protocols at the study institution, study data was archived indefinitely in REDCap.

Summary

The purpose of this chapter was to explain the methods that were used to answer the research questions proposed by this study. This methodology, as informed by the conceptual model, was established to define all variables that were measured, confirm the

reliability and validity of study instruments, set the parameters of eligibility and the criteria used to identify participants, and explain the study design, statistical analysis, and data capture methods that were implemented. The results of the data analysis are reported in the next chapter and discussed and explained in the conclusion of this thesis.

Chapter IV

Results

Introduction

The purpose of this study was to explore the proposition that knowledge of cancer screening guidelines, mediated by health risk and benefit constructs from the CHBM, is associated with the personal cancer screening behaviors of oncology health care professionals (i.e., individuals in the health care profession who specialize in directly providing cancer treatment, services, or supportive care). It conceptualized a parallel mediation model proposing that the heightened knowledge (i.e., awareness and understanding) of cancer screening guidelines among oncology health care professionals increases their perceived susceptibility to cancer, perceived severity of cancer, perceived benefit of screening for cancer, and their perceived ability to take action against cancer, while decreasing their perception of barriers that would prevent them from getting screened for cancer. This model also proposed that the heightened knowledge of cancer screening guidelines, mediated by constructs from the CHBM, increases cancer screening adherence to cervical, breast, and colorectal cancer screening. The results of this survey and the findings of the analysis used to explore the primary and secondary objectives described in the previous chapter are discussed below.

Descriptive Analysis

A total of 690 records for the "Cancer Screening Knowledge, Perceptions, and Behavior Survey" were created in REDCap. These records were created when participants either clicked "submit" after reading the introductory section of the survey (680 participants) or clicked the option to "save and return later" (10 participants). After

clicking “submit” on the introductory survey and reviewing the informed consent, 110 (17.4%) respondents did not proceed further. Of the 570 respondents that remained, 531 consented to take part in the research study (97.3%), 15 respondents did not consent (2.8%), and 24 respondents did not select a response “yes” or “no”, but clicked “submit” on the informed consent instrument. The response rate based on participant consent was 9.7%. The 24 respondents who did not select “yes” or “no” on the informed consent instrument were not directed to any proceeding survey instrument, and the forms were designated as “incomplete”.

Eligibility.

The following eligibility fields were used in this survey: 1) age range (greater than or equal to 21 years); 2) qualified as an oncology health care professional as defined by the study; 3) years of service at the study institution (used to determine that participants were currently employed at the study institution); 4) gender (used for stratification); 5) no previous diagnosis of or treatment for cervical cancer (could exclude participants from answering questions about cervical cancer screening beliefs or behaviors); 6) no previous diagnosis of or treatment for breast cancer (could exclude participants from answering questions about breast cancer screening beliefs or behaviors; and 7) no previous diagnosis of or treatment for colorectal cancer (could exclude participants from answering questions about colorectal cancer screening beliefs or behaviors). Responses to these questions determined which of the subsequent survey sections, if any, the respondents would be eligible to respond to. To summarize a few of the eligibility findings, 84.0% of the respondents were female, 14.4% were male, and less than two percent chose not to answer this question. Non-respondents to this question

were unable to proceed with any of the remaining survey instruments. In terms of age, 39.4% of the respondents were greater than or equal to 21, but less than 40; 28.2% were greater than or equal to 40, but less than 50; and 32.3% were greater than or equal to 50 years of age. Aggregated further by age and gender: 84% (n=421) were female and greater than or equal to 21 years of age; 48.7% (n = 244) were female and greater than or equal to 40 years of age; and 69.3% (n = 347) were male or female and greater than or equal to 50 years of age. While the majority of respondents had worked at the study institution for greater than five years (59%), a significant number of respondents had only worked for the study institution for five years or less (41%). Of those indicating they were an oncology health care professional, 29.6% fell into a clinician category (i.e., physicians and advanced practice providers); 42.2% were nurses (i.e., nurses and case managers); and 28.2% were in ancillary health care fields (e.g., nursing or medical assistant, pharmacist, social worker, technician, etc.). The majority of respondents had never been diagnosed with or treated for cervical, breast, or colorectal cancer. The responses to eligibility screening questions are summarized in Table 5.

Table 5

Eligibility Table

Characteristic	N	%
What is your age?		
Greater than or equal to 21, but less than 30	58	11.42
Greater than or equal to 30, but less than 40	142	27.95
Greater than or equal to 40, but less than 50	143	28.15
Greater than or equal to 50, but less than 60	120	23.62
Greater than or equal to 60, but less than 70	42	8.27
Greater than 70 years	2	0.39
Prefer not to answer	1	0.20

(continued)

Characteristic	N	%
Which one of these groups best represents your oncology health care profession/role?		
I am not an oncology health care professional	11	2.17
Advanced practice provider	115	22.68
Nurse	202	39.84
Nursing or Medical assistant	13	2.56
Pharmacist	28	5.52
Physical or Occupational therapist	23	4.54
Respiratory therapist	2	0.39
Case manager	6	1.18
Social worker	28	5.52
Dietitian/Nutrition support	9	1.78
Chaplain	4	0.79
Technician	9	1.78
Other	23	4.54
How many years have you worked at this comprehensive cancer center?		
0-2 years	92	18.22
3-5 years	114	22.57
6-10 years	89	17.62
11-15 years	106	20.99
16-20 years	71	14.06
21-30 years	26	5.15
Greater than 30 years	7	1.39
Are you...?		
Male	72	14.37
Female	421	84.03
Prefer not to answer	8	1.60
Have you ever been diagnosed with or treated for cervical cancer?		
No	398	97.31
Yes	10	2.44
Prefer not to answer	1	0.24
Have you ever been diagnosed with or treated for breast cancer?		
No	227	94.98
Yes	11	4.60
Prefer not to answer	1	0.42
Have you ever been diagnosed with or treated for colorectal cancer?		
No	157	100.00

Demographics.

The following demographic fields were used in this survey: 1) race/ethnicity and 2) immediate family history (1st degree relative) of cervical, breast, or colorectal cancer. Answering "yes" or "no" to an immediate family history of cervical, breast, or colorectal cancer did not impact eligibility for any of the proceeding survey instruments. The diverse respondent pool (n= 486) was 52.3% White, 14.6% Black/African-American; 10.7% Hispanic, Latino/a, or Spanish origin; 18.5% Asian; and less than two percent American-Indian, Alaskan Native, or other. Seventy-four percent of the respondents did not have an immediate family member or first-degree relative who had been diagnosed with cervical, breast, or colorectal cancer. Responses to these questions are summarized in Table 6.

Table 6

Demographic Characteristics of Survey Respondents

Characteristic	N	%
Which one of these groups would you say best represents your race/ethnicity?		
White	254	52.3
Black or African-American	71	14.6
Hispanic, Latino/a, or Spanish origin	52	10.7
Asian	90	18.5
American-Indian or Alaska Native	1	0.2
Other	6	1.2
Prefer not to answer	12	2.5
Do you have an immediate family member (i.e., 1st degree relative) who has ever		
No	360	74.2
Yes	124	25.6
Prefer not to answer	1	0.2

Research Questions and Findings

Two research questions were posited by this study. The following sections outline the analysis and findings related to each research question. A discussion of the findings is summarized in the final chapter of this thesis.

Research question 1.

"In what ways are the personal cancer screening behaviors of oncology health care professionals at a comprehensive cancer center consistent with the recommended cancer screening guidelines for cervical, breast, and colorectal cancers?"

Finding 1.

This study yielded strong results for cancer screening adherence in the context of oncology health care professionals and validated the hypothesis that "the personal cancer screening behaviors of oncology health care professionals at a comprehensive cancer center are consistent with the recommended cancer screening guidelines for cervical, breast, and colorectal cancers."

Finding 1A: ***Oncology health care professionals were generally adherent to cervical cancer screening***. Only women ages 21 years and older without a prior history of or treatment for cervical cancer were eligible to complete the cervical cancer screening behaviors survey section after completing the section on cervical cancer screening beliefs. The cervical cancer screening behaviors section consisted of a minimum of three questions and a maximum of five questions. Two questions were branching questions that were dependent upon the participants' response to the preceding question. Adherence was reported as completion of a Pap test and HPV test within the recommended guidelines for cervical cancer screening. Adherence (95% CI) was reported separately for both tests.

91.5% of respondents met requirements for Pap test adherence (87- 95%) and 82.8% met requirements for HPV test adherence (77- 88.0%).

The analysis determining adherence excluded participants who responded affirmatively for having a hysterectomy. Although the study did not distinguish between a partial (i.e., may not include removal of the cervix) or total hysterectomy (i.e., includes removal of the cervix), participants who responded affirmatively were analyzed in a similar manner to the BRFSS, which removes these respondents from the analysis. Adherence to cervical cancer screening is shown in Table 7.

Table 7

Cervical Cancer Screening Adherence

Characteristic	N	%
Pap Test Adherence-Excluded hysterectomies		
Did not meet requirements	23	8.5
Met Requirements	247	91.5
HPV Test Adherence-Excluded hysterectomies		
Did not meet requirements	33	17.2
Met Requirements	159	82.8

Note. Cancer screening adherence analyses were compared to the BRFSS Statistical Brief on Cancer Screening Questions (National Center for Chronic Disease Prevention and Health Promotion, 2014)

Finding 1B: Oncology health care professionals were generally adherent to breast cancer screening. Only women ages 40 years and older without a prior history of or treatment for breast cancer were eligible to complete the breast cancer screening behaviors survey instrument after completing the survey instrument for breast cancer screening beliefs. The breast cancer screening behaviors survey instrument consisted of a minimum of one question and a maximum of two questions. One question was a branching question that was dependent upon the participants' response to the preceding question. Adherence (95% CI) was based on completion of a mammogram within the recommended guidelines for breast cancer screening. 85.2% of survey respondents met the requirements for mammography adherence (79 -90%). Breast cancer screening adherence is shown in Table 8.

Table 8

Breast Cancer Screening Adherence

Characteristic	N	%
Mammogram Test Adherence		
Did not meet requirements	25	14.8
Met Requirements	144	85.2

Note. Cancer screening adherence analyses were compared to the BRFSS Statistical Brief on Cancer Screening Questions (National Center for Chronic Disease Prevention and Health Promotion, 2014

Finding 1C: Oncology health care professionals were generally adherent to colorectal cancer screening. Men and women ages 50 years and older without a prior history of or treatment for colorectal cancer were eligible to complete the colorectal cancer screening behaviors survey section after completing the survey section for colorectal cancer screening beliefs. The colorectal cancer screening behaviors survey section consisted of a minimum of two questions and a maximum of five questions. Three questions were branching questions that were dependent upon the participants'

response to the preceding question. The analysis calculated adherence based on a blood stool test within the recommended guidelines or a sigmoidoscopy/colonoscopy (endoscopy) within the recommended guidelines for colorectal cancer screening. Adherence is reported separately for the blood stool test and for the endoscopy and for both tests combined. 86.7% of respondents did not respond positively for having had a blood stool test. However, 95.6% of respondents did respond positively for having had an endoscopy (90 -99%). When adherence to either one of the two tests is combined, 100.0% of respondents met requirements for adherence to colorectal cancer screening. Adherence to colorectal cancer screening is shown in Table 9.

Table 9

Colorectal Cancer Screening Adherence

Characteristic	N	%
Blood Test Adherence		
Did not meet requirements	26	86.67
Met Requirements	4	13.33
Endoscopy Adherence		
Did not meet requirements	4*	4.12
Met Requirements	93	95.88
Endoscopy or Blood Test Adherence		
Met Requirements	93	100.00

Note. Cancer screening adherence analyses were compared to the BRFSS Statistical Brief on Cancer Screening Questions (National Center for Chronic Disease Prevention and Health Promotion, 2014).
*Respondents did not select a response and were counted as "Did not meet requirements".

Research question 2.

"To what extent are knowledge and mediating factors from the CHBM (i.e., perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and perceived self-efficacy) associated with the personal cancer screening behaviors of oncology health care professionals at a comprehensive cancer center?"

Finding 2. The results demonstrated mixed findings. Knowledge and mediating factors from the CHBM have some influence on the personal cancer screening behaviors of oncology health care professionals. However, little to no mediating effect between knowledge, the CHBM, and adherence was detected. First, an analysis was conducted to evaluate the reliability, or internal consistency, of the CHBM instrument used in this study population. For the cervical cancer scale, Cronbach's -coefficient alpha was .91. (Cervical subscale Cronbach's alpha coefficients: cervical susceptibility = .90; cervical severity = .92; cervical benefits = .77; cervical barriers = .95; cervical self-efficacy = .96). For the breast cancer scale, Cronbach's –coefficient alpha was .91. (Breast subscale Cronbach's alpha coefficients: breast susceptibility = .94; breast severity = .93; breast benefits = .74; breast barriers = .93; breast self-efficacy = .96). For the colorectal cancer scale, Cronbach's coefficient-alpha was .91. (Colorectal subscale Cronbach alpha coefficients: colorectal susceptibility = .94; colorectal severity = .91; colorectal benefits = .77; colorectal barriers = .92; colorectal self-efficacy = .96).

Finding 2A: Oncology health care professionals were moderately knowledgeable about cancer screening guidelines for cervical, breast, and colorectal cancer. All eligible participants, regardless of their gender, age range, or history of cervical, breast, or colorectal cancer, were given the opportunity to respond to the "knowledge about cancer screening guidelines" section of the survey. This section consisted of 14 questions from the HINTS survey as previously described in the Methodology chapter. The answer key for this survey section was developed utilizing the HINTS briefs and related articles associated with each question from the HINTS questions database available at https://hints.cancer.gov/. The answer key and distribution

of responses for this study is located in Appendix I. Scoring of this survey instrument resulted in a mean (95% CI) knowledge score of 66.35 (64.97 – 67.73) and a median (Min-Max) of 71.43 (71.4 – 100.00).

When it comes to cervical cancer, 90.8% of respondents understood that HPV can cause abnormal Pap tests, 96.8% recognized that HPV can cause cervical cancer, and 92.7% correctly believed that women who get the cervical cancer vaccine or HPV shot should continue to get screened for cervical cancer with the Pap test. However, only 65.3% had heard about the change in guidelines to receive Pap test screening every three years. Approximately eighty percent believed that the Pap test was very successful or pretty successful in detecting cervical cancer in its earliest stages.

For breast cancer screening, knowledge was relatively modest. Sixty-eight percent of respondents correctly answered that women should start having mammograms at the age of 40 years. Seventy-three percent knew that they should have a mammogram every one to two years.

Finally, in assessing knowledge of colorectal cancer screening, 70.2% of respondents were aware that colorectal cancer screening should begin at the age of 50 years. Interestingly, only 60.0% recognized that it coincides with the risk of colorectal cancer being greatest between the ages of 40 and 60 years. Although 82.2% of respondents believed that getting checked regularly for colon cancer increases the chances of finding cancer when it’s easy to treat, 71.7% believed that, generally, people with colon cancer would have pain or other symptoms prior to being diagnosed. The frequency of screening tests for colorectal cancer was less understood. Only 38.3% knew the frequency for blood stool testing, a mere 28.9% knew the frequency for having a

sigmoidoscopy, and a scant 13.7% knew the frequency of a colonoscopy exam. The full summary of correct and incorrect answers to the "knowledge about cancer screening guidelines" survey section can be found in Appendix J.

Finding 2B: Oncology health care professionals had strong beliefs about cervical cancer screening benefits and self-efficacy. As outlined in the Methodology chapter, stratification based on gender, age range, and previous diagnosis of or treatment for cervical, breast, or colorectal cancer was built into the survey instrument. Therefore, only women ages 21 years and older without a prior history of or treatment for cervical cancer were eligible to complete the section on cervical cancer screening beliefs.

Each section on cancer screening beliefs consisted of 39 statements from the CHBM using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) as previously described in the Methodology chapter. Similarly to other research studies using the CHBM, the Likert format was coded so that Strongly Agree was equal to 5, strongly disagree was equal to 1. Missing data was coded as neutral and given a value of 3. Items were written so that a higher score on susceptibility, seriousness, benefits, barriers, and self-efficacy indicates a stronger feeling on each concept. For cervical cancer, strong beliefs were associated with cervical cancer screening benefits (4.04) and cervical cancer screening self-efficacy (4.40). As a result, participants in this study perceived that cervical cancer screening is beneficial and perceived that they are able to get screened for cervical cancer. Cervical cancer screening self-efficacy had the highest average perception score out of all of the CHBM factors for cervical cancer. These results are reflected in Table 10.

Table 10

Cervical Cancer Screening Beliefs (CHBM)

Characteristic	N	%
CHBM Cervical Susceptibility		
N	343	
Mean (SD)	1.87	(0.79)
Median (Min-Max)	2.00	1.00 - 4.33
CHBM Cervical Severity		
N	343	
Mean (SD)	2.65	(0.83)
Median (Min-Max)	2.58	1.00 - 5.00
CHBM Cervical Benefits		
N	343	
Mean (SD)	4.04	(0.58)
Median (Min-Max)	4.00	1.60 - 5.00
CHBM Cervical Barriers		
N	343	
Mean (SD)	1.44	(0.51)
Median (Min-Max)	1.18	1.00 - 3.36
CHBM Cervical Self-efficacy		
N	343	
Mean (SD)	4.40	(0.64)
Median (Min-Max)	4.50	1.00 - 5.00

Finding 2C: Oncology health care professionals had strong beliefs about breast cancer screening benefits and self-efficacy. Only women ages 40 years and older without a prior history of or treatment for breast cancer were eligible to complete the section on breast cancer screening beliefs. Each section on cancer screening beliefs consisted of 39 statements from the CHBM using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) as previously described in the Methodology chapter. Similarly to other research studies using the CHBM, the Likert format was coded so that Strongly Agree was equal to 5, strongly disagree was equal to 1. Missing data was coded as neutral and given a value of 3. Items were written so that a higher score on susceptibility, seriousness, benefits, barriers, and self-efficacy indicate a stronger feeling on each concept. Strong beliefs for breast cancer were associated with breast cancer screening benefits (3.85) and breast cancer screening self-efficacy (4.45). Thus, participants in this study perceived that breast cancer screening is beneficial and perceived that they are able to get screened for breast cancer. Breast cancer screening self-efficacy had the highest average perception score out of all of the CHBM factors for breast cancer. The results of this analysis are listed in Table 11.

Table 11

Breast Cancer Screening Beliefs (CHBM)

Characteristic	**N**	**%**
CHBM breast Susceptibility		
N	183	
Mean (SD)	2.45	(0.85)
Median (Min-Max)	2.33	1.00 - 4.67
CHBM breast Severity		
N	183	
Mean (SD)	2.64	(0.83)
Median (Min-Max)	2.58	1.00 - 5.00
CHBM breast Benefits		
N	183	
Mean (SD)	3.85	(0.62)
Median (Min-Max)	3.80	2.00 - 5.00
CHBM breast Barriers		
N	183	
Mean (SD)	1.55	(0.54)
Median (Min-Max)	1.36	1.00 - 3.18
CHBM breast Self-efficacy		
N	183	
Mean (SD)	4.45	(0.56)
Median (Min-Max)	4.63	2.25 - 5.00

Finding 2D: Oncology health care professionals have strong beliefs about colorectal cancer screening benefits and self-efficacy. Men and women ages 50 years and older without a prior history of or treatment for colorectal cancer were eligible to complete the section on colorectal cancer screening beliefs. Each section on cancer screening beliefs consisted of 39 statements from the CHBM using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) as previously described in the Methodology chapter. Similarly to other research studies using the CHBM, the Likert format was coded so that Strongly Agree was equal to 5, strongly disagree was equal to 1. Missing data was coded as neutral and given a value of 3. Items were written so that a higher score on susceptibility, seriousness, benefits, barriers, and self-efficacy indicate a stronger feeling on each concept. For colorectal cancer, strong beliefs were associated with colorectal cancer screening benefits (4.12) and colorectal cancer screening self-efficacy (4.42). As a result, participants in this study perceived that colorectal cancer screening is beneficial and perceived that they are able to get screened for colorectal cancer. Colorectal cancer screening self-efficacy had the highest average perception score out of all of the CHBM factors for colorectal cancer. The results of this analysis are shown in Table 12.

Table 12

Colorectal Cancer Screening Beliefs (CHBM)

Characteristic	**N**	**%**
CHBM colon Susceptibility		
N	119	
Mean (SD)	2.39	(0.84)
Median (Min-Max)	2.33	1.00 - 5.00
CHBM colon Severity		
N	119	
Mean (SD)	2.57	(0.80)
Median (Min-Max)	2.58	1.00 - 5.00
CHBM colon Benefits		
N	119	
Mean (SD)	4.12	(0.55)
Median (Min-Max)	4.00	3.00 - 5.00
CHBM colon Barriers		
N	119	
Mean (SD)	1.65	(0.56)
Median (Min-Max)	1.82	1.00 - 3.00
CHBM colon Self-efficacy		
N	119	
Mean (SD)	4.42	(0.61)
Median (Min-Max)	4.50	1.00 - 5.00

Findings were consistent that perceptions of benefits and self-efficacy were strongest across all three cancer types, whereas perceptions about susceptibility, severity, and barriers to screening were lower. Summary statistics for cervical cancer screening beliefs, breast cancer screening beliefs, and colorectal cancer screening beliefs are available in Appendices, K, L, and M, respectively.

Finding 2E: Knowledge had a statistically significant positive influence on Pap test and mammography adherence. The first step in the mediation analysis sequence proposed by Baron and Kenny (1986) was to explore associations between knowledge (independent) and adherence (dependent). Logistic regression models were conducted with knowledge as the covariate in the model and adherence to cancer screening guidelines as the outcome (BRFSS) for each of the cancer types (i.e., cervical, breast, and colorectal). Associations between the knowledge score and adherence in this analysis yielded the following results. As knowledge score increases, the odds of Pap test adherence increases by a factor of 1.04 (95% CI: 1.01 – 1.07; p = 0.013) and the odds of mammography adherence increases by a factor of 1.05 (95% CI: 1.02- 1.08; p = 0.003). Associations between knowledge scores and HPV (p = 0.404) and colorectal cancer screening (p = 0.440) adherence did not yield statistically significant results. Consequently, step one in the mediation sequence did not demonstrate a direct relationship between knowledge and HPV or knowledge and colorectal cancer screening and was therefore not consistent with the mediation hypothesis proposed by this study. The results of these analyses are reflected in Tables 13, 14, 15, and 16.

Table 13

Effect of Knowledge on Pap Test Adherence

	Non Adherent		Adherent						
Effect	N	%	N	%	p-value*	OR	LB	UB	p-value
Knowledge Score	62.4 (14.3)	35.7 - 85.7	69.8 (13.1)	28.6 - 92.9	0.016	1.04	1.01	1.07	0.013

Table 14

Effect of Knowledge on HPV Adherence

	Non Adherent		Adherent						
Effect	N	%	N	%	p-value*	OR	LB	UB	p-value
Knowledge Score	68.2 (14.7)	35.7 - 92.9	70.3 (12.7)	28.6 - 92.9	0.431	1.01	0.98	1.04	0.404

Table 15

Effect of Knowledge on Mammography Adherence

	Non Adherent		Adherent						
Effect	N	%	N	%	p-value*	OR	LB	UB	p-value
Knowledge Score	62.0 (13.0)	28.6 - 85.7	71.2 (12.8)	7.1 - 100.0	0.001	1.05	1.02	1.08	0.003

Table 16

Effect of Knowledge on Colonoscopy Adherence

	Non Adherent		Adherent						
Effect	N	%	N	%	p-value*	OR	LB	UB	p-value
Knowledge Score	64.3 (19.3)	35.7 - 78.6	69.4 (12.8)	21.4 - 100.0	0.779	1.03	0.96	1.10	0.440

Finding 2F: Knowledge had a very small, but statistically significant influence on cervical cancer susceptibility, cervical cancer severity, cervical cancer screening benefits, cervical cancer screening barriers, and cervical cancer screening self-efficacy. Step two in the mediation analysis proposed by Baron and Kenny (1986) was to explore associations between knowledge and the CHBM constructs. In step one, knowledge was directly associated with Pap testing, but not associated with HPV testing. Linear regression models were conducted with knowledge (independent) as the covariate and CHBM (mediators) as the outcome. In this particular analysis, for every one unit increase in knowledge score, the CHBM cervical susceptibility score decreased slightly by an average of 0.011 units (95% CI: -0.017 - -0.005; p = 0.001). By the same token, the CHBM cervical severity score decreased slightly by an average of 0.007 units (95% CI:-0.014 - -0.001; p = 0.021). In some ways, these findings were contrary to the conceptual model proposed by this study. The conceptual model proposed that for every unit increase in knowledge score, cervical cancer susceptibility and cervical cancer severity scores should increase. On the other hand, for every one unit increase in knowledge score, the CHBM cervical benefits score increased slightly by an average of 0.007 units (95% CI: 0.003- 0.012; p = 0.001); the CHBM cervical barriers score decreased slightly by an average of 0.009 units (95% CI: -0.013- -0.005; p = 0.001); and the CHBM cervical self-efficacy score increased slightly by an average of 0.010 units (95% CI: 0.005- 0.015; p = 0.001). These findings were in agreement with the conceptual model of this study, which proposed that for every unit increase in knowledge score, the cervical cancer screening benefit score should increase, the cervical cancer screening barriers score should decrease, and the cervical cancer screening self-efficacy score

should increase, although the results demonstrate a very small effect. These results demonstrate only a minimal association between knowledge and the CHBM factors for cervical cancer screening. The associations between knowledge and cervical cancer severity, barriers, and benefits are practically non-existent, while only minimal associations with cervical cancer susceptibility and self-efficacy exist. The results of this analysis are reflected in Table 17.

Table 17

Association Between Knowledge and Cervical Cancer Beliefs (CHBM)

Effect	Coefficient	95% LB	95% UB	p-value	R2
N = 343					-
CHBM Cervical Susceptibility	-0.011	-0.017	-0.005	*<0.001	0.040
CHBM Cervical Severity	-0.007	-0.014	-0.001	*0.021	0.016
CHBM Cervical Benefits	0.007	0.003	0.012	*0.001	0.033
CHBM Cervical Barriers	-0.009	-0.013	-0.005	*<0.001	0.059
CHBM Cervical Self-efficacy	0.010	0.005	0.015	*<0.001	0.049

(R2 values are typically lower than 50% in fields attempting to predict human behavior.)

Finding 2G: Knowledge has a very small, but statistically significant influence on breast cancer screening benefits, breast cancer screening barriers, and breast cancer screening self-efficacy. Step two in the mediation analysis proposed by Baron and Kenny (1986) was to explore associations between knowledge and the CHBM constructs. In step one of the mediation analysis, knowledge was directly associated with mammography testing. Linear regression models were conducted with knowledge (independent) as the covariate and CHBM (mediators) as the outcome. The results demonstrated that for every one unit increase in knowledge score, the CHBM breast benefits score slightly increased by an average of 0.007 units (95% CI: 0.000- 0.014; p = 0.036); the CHBM breast barriers score decreased slightly by an average of 0.010 units (95% CI: -0.015- -0.004; p = 0.001); and the breast self-efficacy score increased slightly

by an average of 0.009 units (95% CI: 0.003- 0.015; p = 0.003). These findings are somewhat in agreement with the conceptual model of this study, which proposed that for every one unit increase in knowledge score, the breast cancer screening benefits score should increase, the breast cancer screening barriers score should decrease, and the breast cancer screening self-efficacy score should increase, although the results demonstrate a very small effect. These results demonstrate only a minimal association between knowledge and the CHBM factors for breast cancer screening. The associations between knowledge and breast cancer susceptibility and severity were not statistically significant. The associations between knowledge and breast cancer screening benefits and self-efficacy are practically non-existent, while only a minimal association with breast cancer barriers exists. The results of this analysis are reflected in Table 18.

Table 18

Association Between Knowledge and Breast Cancer Beliefs (CHBM)

Effect	Coefficient	95% LB	95% UB	p-value	R2
N = 183					-
CHBM Breast Susceptibility	0.006	-0.004	0.015	0.223	0.008
CHBM Breast Severity	0.002	-0.007	0.011	0.669	0.001
CHBM Breast Benefits	0.007	0.000	0.014	*0.036	0.024
CHBM Breast Barriers	-0.010	-0.015	-0.004	*0.001	0.057
CHBM Breast Self-efficacy	0.009	0.003	0.015	*0.003	0.047

(R2 values are typically lower than 50% in fields attempting to predict human behavior.)

Finding 2H: Knowledge had a very small, but statistically significant influence on colorectal cancer screening barriers and colorectal cancer screening self-efficacy. Step two in the mediation analysis proposed by Baron and Kenny (1986) was to explore associations between knowledge and the CHBM constructs. This analysis was conducted for colorectal cancer screening even though step one in the mediation analysis did not

demonstrate a direct relationship between knowledge and colorectal cancer screening. Linear regression models were conducted with knowledge (independent) as the covariate and CHBM (mediators) as the outcome. Based on the results of this study, for every one unit increase in knowledge score, the CHBM colon barriers score decreased slightly by an average of 0.011 units (95% CI: -0.018- -0.003; p = 0.006) and the CHBM colon self-efficacy score increased slightly by an average of 0.012 units (95% CI: 0.003- 0.020; p = 0.006). These results are in agreement with the conceptual model of this study, which proposed that for every one unit increase in knowledge score, the colorectal cancer screening barriers score should decrease and the colorectal cancer screening self-efficacy score should increase. Again, the effect, however, was very small. These results demonstrate that there is no statistically significant association between knowledge and colorectal cancer susceptibility, severity, or benefits. These results demonstrate only a minimal association between knowledge and colorectal cancer screening barriers and self-efficacy. Results of this analysis are reflected in Table 19.

Table 19

Association Between Knowledge and Colorectal Cancer Beliefs (CHBM)

Effect	Coefficient	95% LB	95% UB	p-value	R2
N = 119					-
CHBM Colon Susceptibility	-0.010	-0.022	0.001	0.087	0.025
CHBM Colon Severity	-0.002	-0.013	0.009	0.752	0.001
CHBM Colon Benefits	0.008	0.000	0.015	0.052	0.032
CHBM Colon Barriers	-0.011	-0.018	-0.003	*0.006	0.062
CHBM Colon Self-efficacy	0.012	0.003	0.020	*0.006	0.063

(R2 values are typically lower than 50% in fields attempting to predict human behavior.)

Finding 2I: A few, but not all, of the CHBM factors had some effect on cancer screening adherence. In general, mediation occurs when the (1) independent variable significantly affects the outcome variable in the absence of the mediator; (2) the independent variable significantly affects the mediator; and (3) when the effect of the independent on the outcome shrinks upon the addition of the mediator. In order for this to occur, generally the mediator has a significant unique effect on the outcome variable. Since some of the associations between the independent (knowledge) and mediator (CHBM) variables were statistically significant, but minimal, logistic regression models were first conducted with CHBM as the covariate and adherence as the outcome to determine the unique effect of the mediating variables on the outcome. The results of the analysis between the CHBM and adherence indicate that as the CHBM cervical barriers score increases, the odds of Pap test adherence decreases by a factor of 0.25 (95% CI: 0.11– 1.070.56; p = 0.001); as the CHBM breast barriers score increases, the odds of mammography adherence decreases by a factor of 0.40 (95% CI: 0.18- 0.89; p = 0.025); and as the CHBM colon barriers score increases, the odds of colorectal cancer screening decreases by a factor of 0.06 (95% CI: 0.01- 0.63; p = 0.019). In addition, as the CHBM cervical susceptibility score increases, the odds of HPV test adherence increases by a factor of 1.97 (95% CI: 1.13- 3.42; p = 0.016). None of the other CHBM factors demonstrated statistically significant associations with adherence. These results demonstrate a unique effect of the perception of barriers on adherence to cervical, breast, and colorectal cancer screening and the perception of cervical susceptibility on HPV test adherence. The largest effects were between perceptions of barriers to colorectal cancer screening and adherence to colorectal cancer screening and between cervical cancer

susceptibility and adherence to the HPV test. The regression models assessing knowledge and CHBM constructs on adherence are located in Appendix N.

Since knowledge demonstrated a direct effect on Pap testing and mammography adherence and there were minimal, but statistically significant associations between knowledge and some of the CHBM factors for cervical and breast cancer screening, step three in the mediation analysis proposed by Baron and Kenny (1986) was conducted for these two adherence tests. Step three in the mediation analysis was used to explore associations between knowledge (independent) plus the CHBM (mediators) constructs and adherence (outcome). In this case, the analysis was conducted controlling for the independent variable to determine if the mediator shrinks the effect between knowledge and adherence. The Sobel test is one test that can be used to determine whether the mediator carries the influence of the independent to dependent variable. When the regression analysis was conducted with knowledge plus the CHBM and Pap testing as the outcome, the Sobel test for cervical cancer screening barriers was significant for mediation at .015. When the regression analysis was conducted with knowledge plus the CHBM and mammography as the outcome, none of the Sobel test results were significant for mediation (Appendix N).

In summary, the results of the logistic regression analyses between the CHBM factors and adherence demonstrated that the perception of barriers was directly associated with adherence for all three cancer types (i.e., Pap testing, mammography, colorectal cancer screening). The analysis also demonstrated a direct relationship between cervical cancer susceptibility and HPV testing. However, since step one in the mediation analysis only demonstrated relationships between knowledge and Pap testing and knowledge and

mammography, proposed mediation of the CHBM factors between knowledge and adherence to HPV testing and knowledge and adherence to colorectal cancer screening were rejected. Further regression analyses between knowledge and CHBM factors demonstrated some statistically significant findings that were relatively small. The strongest associations, in most cases, were between knowledge and perceptions of barriers and self-efficacy. Although statistically and perhaps theoretically significant, these associations were minimal and therefore not deemed practically for the purposes of this study. Performance of step three in the mediation analysis was only conducted for Pap testing and mammography adherence and demonstrated a possible mediation path between knowledge, perceptions of cervical cancer screening barriers, and Pap testing. Again, however, since the relationship between knowledge and cervical cancer screening barriers was extremely small, a mediation path may not be present in this case. Mediation testing was not significant between knowledge, CHBM factors, and mammography.

Finding 2J: There were some associations between demographic variables and adherence. Although demographic factors were not the focus of this study, notable associations were observed between age and Pap test adherence and years of service and HPV adherence. Age was associated with Pap test adherence with older age being less likely to adhere (Age = 40- 50; OR = 0.30; 95% CI: 0.10- 0.93; $p = 0.037$; and Age ≥ 50; OR = 0.22; 95% CI: 0.07- 0.68; $p = 0.009$). And, years of service was associated with HPV adherence with those with more years of service less likely to have an HPV test (Years of service = 20+; OR = 0.04; 95% CI: 0.00- 0.43; $p = 0.008$). The results from this analysis are located in Appendix O.

Summary

This research study examined knowledge of cancer screening guidelines for cervical, breast, and colorectal cancers in oncology health care professionals and its relationship to cancer screening beliefs or perceptions about cervical, breast, and colorectal cancers and their influence on the performance of cancer screening behaviors. Knowledge of cancer screening guidelines was assessed and scored based on the Health Information National Trends Survey (HINTS) instrument. Cancer screening beliefs were based on the modified Champion Health Belief Model (CHBM) instrument consisting of five identified constructs: 1) susceptibility; 2) severity (threat); 3) barriers; 4) benefits; and 5) self-efficacy. And, the Behavioral Risk Factor Surveillance System (BRFSS) instrument was used to assess cancer screening behaviors as the outcome variable. This chapter reported on the results of an analysis using descriptive statistics and regression models to explore the primary and secondary objectives of this research study. A discussion of these results, including the limitations of the study, is reviewed in the final chapter of this thesis.

Chapter V

Discussion

Introduction

The intent of this study was to explore the proposition that knowledge of cancer screening guidelines, mediated by health risk and benefit constructs from the CHBM, is associated with the personal cancer screening behaviors of oncology health care professionals (i.e., individuals in the health care profession who specialize in directly providing cancer treatment, services, or supportive care). Therefore, in the context of oncology health care professionals, this research study conceptualized a parallel mediation model proposing that one's heightened knowledge (i.e., awareness and understanding) of cancer screening guidelines increases one's perceived susceptibility to cancer, perceived severity of cancer, perceived benefit of screening for cancer, and one's perceived ability to take action against cancer, while decreasing one's perception of barriers to cancer screening, thereby increasing one's adherence to cervical, breast, and colorectal cancer screening exams. The following discussion expounds on the results of this research study, explores the implications of future research in this field, and summarizes its limitations.

Discussion of Results

The following table summarizes the findings as it relates to each of the research questions and identifies the implications of each finding as theory, research, and/or practice-based. Each of the findings, implications, and future recommendations are then discussed in more detail in the remainder of this chapter.

Table 20

Summary of Research Findings and Implications

Research Finding	Implication(s)
Finding 1. The personal cancer screening behaviors of oncology health care professionals are consistent with the recommended cancer screening guidelines for cervical, breast, and colorectal cancers.	**Practice.** This finding has potential implications on the practice of oncology health care professionals and their influence on the cancer screening behaviors of their patients. **Research:** Future recommendations include continuing to explore the adherence of oncology health care professionals to other cancer screening guidelines like prostate cancer screening and protective behaviors like smoking cessation and limited UV exposure.
Finding 2A: Oncology health care professionals are moderately knowledgeable about cancer screening guidelines.	**Practice.** This finding has implications on the practice of oncology health care professionals as advocates and educators. However, opportunities exist to improve their knowledge base in areas like the frequency of cancer screening exams.
Finding 2B, C, D: Oncology health care professionals have strong beliefs about several of the CHBM factors.	**Theory:** This finding has implications on the CHBM as a health behavior theory. **Research:** The translation of theory into practice for oncology health care professionals should continue to be explored.
Finding 2E: Knowledge has a statistically significant positive influence on Pap test and mammography adherence.	**Theory:** This finding is important in the continued development of health behavior theory and the role of modifying factors on health behaviors. **Practice:** This finding could be important in the development of practice-based initiatives that support knowledge-based cancer screening tools. **Research:** Future recommendations include exploring why this finding might be true for some cancer screening exams and not others.
Finding 2F, G, H: Knowledge has a very minimal, but statistically significant influence on CHBM factors.	**Theory:** This finding does not support the association between this factor and CHBM factors in this population setting.
Finding 2I: A few, but not all, of the *CHB*M factors had some effect on cancer screening adherence.	**Theory:** This finding supports the CHBM model for some, but not all of the CHBM factors. **Practice:** This finding may have some implications for education efforts related to cancer screening adherence.
Finding 2J: There were some associations between demographic variables and adherence.	**Research:** Future recommendations include exploring why race/ethnicity and other

	demographic variables had no impact in this population setting.

Finding 1: The personal cancer screening behaviors of oncology health care professionals are consistent with the recommended cancer screening guidelines for cervical, breast, and colorectal cancers. Central to the basic premise of this research study was the question of whether or not oncology health care professionals practice what they preach. That is to say, are their personal cancer screening behaviors consistent with the recommended cancer screening guidelines that their profession promotes? The findings of this research study confirmed that oncology health care professionals strongly adhere to recommended cancer screening guidelines for cervical, breast, and colorectal cancers. The implications of these findings suggest that oncology health care professionals could play a pivotal role in educating their patients and the community about the vital importance of cancer screening through health behavior modeling. As previously stated in the introduction to this study, Texas oncology health care professionals have a mandate from the Texas Cancer Plan (TCP) to "provide culturally relevant counseling, information, and referrals for cancer screening tests" and "adhere to guidelines and best practices for prevention, treatment, and supportive care" (TCP, 2012, p.7). One of the ways to provide relevant counseling and information is through the sharing of personal cancer screening experiences. Per the aforementioned literature review, research already suggests that modeling of preventive health behaviors (i.e., disclosure of personal compliance with cancer screening guidelines) by health care workers may influence patients to adopt preventive health behaviors themselves (Black et al., 2012; Frank et al., 2000; Frank et al., 2013; Oberg & Frank, 2009; Wee, McCarthy, &

Phillips, 2005; Wells et al., 1984). Recommendations for future research include assessing whether this premise is true. Do oncology health care professionals who adhere to cancer screening guidelines actually recommend or influence their patients to adopt cancer screening behaviors themselves? Other recommendations based on this finding include exploring the adherence of oncology health care professionals to other cancer screening guidelines such as prostate cancer screening or preventive practices such as smoking cessation and limited exposure to the sun and UV radiation.

Finding 2A: Oncology health care professionals are moderately knowledgeable about cancer screening guidelines. The majority of the results from this section of the survey were encouraging. As a whole, oncology health care professionals were very knowledgeable about HPV, its potential effect on abnormal Pap tests, and its role in the development of cervical cancer. Respondents also had strong beliefs in the ability of the Pap test to detect cervical cancer in its earliest stages. Of concern, however, was the fact that only about two-thirds of respondents had heard about the change in guidelines regarding the frequency of Pap tests. This change in guidelines actually increased the frequency window between preventive screening exams from annually to every three years, thereby increasing the likelihood of adherence. Therefore, although there was a lack of knowledge about this change in guidelines, it did not negatively impact adherence since adherence was inclusive of Pap test exams anytime within the last three years. However, the importance of this particular finding calls into question the way in which evidence-based guidelines are disseminated to health care professionals. If the frequency window had been shortened, would to Pap test exams still be high? How are health care professionals educated, who is responsible for educating them, and how are

they held accountable for receiving and understanding changes in clinical practice guidelines? This is especially important because clinical practice guidelines not only impact the personal health behaviors of health care professionals, but the health care practices they promote for their patients.

Oncology health care professionals were also moderately knowledgeable about breast cancer screening. This included the age at which women should begin screening for breast cancer and how often they should have mammography exams. However, the question that was not explored within the context of this study was their source of cancer screening knowledge. Awareness about breast cancer has more national prominence than awareness about cervical or colorectal cancer screening, although awareness campaigns about HPV vaccination have risen in recent years. How do national campaigns factor in the dissemination of cancer screening knowledge? Future research should explore whether the source of knowledge as it pertains to cancer screening guidelines may play an important role in the broad dissemination and retention of cancer screening knowledge components among oncology health care professionals and the general public.

Conversely, knowledge about colorectal cancer screening was a bit more concerning. There was an obvious knowledge deficit about the frequency of screening tests for colorectal cancer. This finding was irrespective of the type of colorectal cancer screening exam selected. Even though colonoscopy exams were heavily favored as the screening method of choice by the study population as opposed to blood stool tests, the knowledge score about the recommended frequency of colonoscopy exams was even lower than the knowledge score about the recommended frequency of blood stool tests. While none of these knowledge deficits impacted the colorectal cancer screening

adherence rate of oncology health care professionals, the concern with these findings is the strong potential for misinformation. If oncology health care professionals struggle to understand the frequency at which colorectal cancer screening exams should occur, how can public health officials and experts expect the general public to remember this crucial information? Would frequency be easier to remember if there were fewer approved screening methods, similar to cervical and breast cancer screening? One could assume that offering a variety of options for colorectal cancer screening would make adherence more attainable. While this could be true, it may also force consumers to rely even more heavily on clinicians to provide appropriate recommendations for colorectal cancer screening exams accompanied by the appropriate timeframes within which each type of exam should occur. Hence, it is even more critical for health care professionals to take an active approach to understanding all facets of cancer screening guidelines, including the frequency of recommended cancer screening exams.

Therefore, although oncology health care professionals are familiar with the importance of cancer screening exams in general, there is a knowledge gap when it comes to the frequency of these exams, and in some cases, the age at which these screening exams should commence. Speculation regarding this misinformation could be related to the existence of somewhat conflicting guidelines between the American Cancer Society (ACS), United States Preventive Services Taskforce (USPSTF), and other specialty organizations. A dissemination gap may also exist across oncology disciplines when practice guidelines change. Thus, future recommendations include focusing efforts on improving the dissemination of cancer screening guidelines to oncology health care professionals and standardizing, if possible, the evidence-based guidelines recommended

by expert organizations and groups. This could have a dramatic impact on improving the cancer screening practices of practitioners as they guide the cancer screening behaviors of their patients.

Finding 2B, C, D: Oncology health care professionals have strong beliefs about several of the CHBM factors.

There were five factors evaluated using the CHBM: 1) susceptibility; 2) severity; 3) barriers; 4) benefits; and 5) self-efficacy. Although the CHBM is evaluated holistically, in this rational decision model, each variable is independent of the other, and each has been shown to be more predictive of behavior depending upon the population and outcome measure being evaluated (Glanz et al., 2002). This independence of variables proved to be true in this study as well. According to these findings, respondents did not have strong feelings about being susceptible to these three cancer types, nor did they believe in the severity of these three cancer diagnoses. Thus, according to the CHBM, participants did not perceive that the threat of cervical, breast, or colorectal cancer was high. Instead, the strongest held beliefs were associated with the benefits of cancer screening and the ability to get screened for these three cancer types.

Additionally, it is just as important to note that perceptions about barriers to cancer screening was especially low. While this study further attempted to determine if knowledge of cancer screening guidelines was associated with these beliefs, these findings demonstrate some support for the CHBM factors in the realm of health behavior theory, even in the context of oncology health care professionals. Why did oncology health care professionals have such a low perception about the threat of cancer? Were their low perceptions about susceptibility and severity influenced by their recognition of

the availability of early detection and treatment resources at the comprehensive cancer center where they work? Were their low perceptions about the barriers to cancer screening related to the accessibility of cancer prevention testing for employees at the comprehensive cancer center where they work? Conversely, were their high perceptions about benefits and self-efficacy a reflection of both availability and accessibility to early detection, treatment, and support resources at the comprehensive cancer center where they work? Future research should continue to explore the translation of the theory of health beliefs into actual practice. Is the goal of this theory to be predictive or explanatory? Do these findings adequately explain the behavior of oncology health care professionals based on their CHBM beliefs? Per the literature, communication researchers are primarily interested in examining the CHBM as an explanatory framework, although it has significant limitations in this capacity (Jones, Jensen, Scherr, brown, Christy, & Weaver, 2014). The next few findings will discuss these beliefs and their actual associations with knowledge and cancer screening adherence.

Finding 2E: Knowledge has a statistically significant positive influence on Pap test and mammography adherence.

One of the significant findings from this study was the relationship between the independent variable (knowledge) and the outcome variable (adherence). The two main questions that prompted this entire investigation were “are oncology health care professionals adherent to cancer screening guidelines” and if they are adherent, “why are they adherent to cancer screening guidelines?” The results from this study were clear. Oncology health care professionals are indeed adherent to cancer screening guidelines. But, why? This study hypothesized that their increased knowledge of cancer screening

guidelines, mediated by CHBM factors, prompted their adherence to those guidelines. If this were proven to be true, could this information be used to increase adherence in the general public?

Thus, this finding that knowledge had a statistically significant positive influence on Pap test and mammography adherence seems to be an important one. By the same token, knowledge did not have a direct effect on HPV and colorectal cancer screening adherence. These findings have practical implications as well as theoretical ones.

Why did knowledge have a direct effect on some cancer screening exams and not others? Where does knowledge fit overall in existing health behavior theory? In the theoretical model proposed by Champion and Skinner (2008), knowledge is identified as a modifying factor along with other variables such as age, gender, ethnicity, and socioeconomics. Perhaps future research should investigate not only specific knowledge components as individual factors that affect an outcome, but knowledge in combination with other modifying factors. For example, the most concerning knowledge component deficit across all screening exams pertained to the frequency of testing. Yet, lack of knowledge about this specific component of cancer screening guidelines did not appear to negatively affect adherence. Knowledge scores regarding the frequency of colorectal cancer screening exams was especially low. Yet, adherence to colorectal cancer screening was 100% when blood stool testing and endoscopy (colonoscopy and sigmoidoscopy) were combined. On the other hand, knowledge scores about HPV testing were exceptionally high along with adherence to HPV testing, but there was not a statistically significant relationship between knowledge and HPV testing. Were there certain knowledge components about Pap tests and mammography that influenced adherence

more than knowledge components about HPV and colorectal cancer screening? Were there additional modifying factors, like gender, age, or socioeconomic status that may have influenced the association between knowledge and adherence to HPV or colorectal cancer testing as opposed to knowledge and adherence to Pap or mammography testing? Future studies should investigate these and other questions about modifying factors from the CHBM.

In addition, many patients look to health care providers as the source of truth. They rely on clinicians to advise them on what tests to have and when to have them. Therefore, clinicians need to be empowered with the most accurate information to share with their patients and use evidence-based guidelines to highlight which specific knowledge components should be promoted most. They should also be informed if other factors may play a role in the adherence of their patients to cancer screening recommendations.

Finding 2F, G, H, I: Knowledge had a very minimal, but statistically significant influence on CHBM factors and a few of the CHBM factors had an effect on cancer screening adherence.

In addition to exploring the relationship between knowledge and adherence as an answer to the "why", this study tested the CHBM theory using factors of perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and perceived self-efficacy as mediators between knowledge and adherence. This study proposed that a parallel mediation model exists wherein all of the CHBM constructs (susceptibility, severity, benefits, barriers, and self-efficacy) mediate the relationship between knowledge

and behavior. The results of this study yielded little to no effect between these factors and knowledge or adherence as proposed by the model.

As previously noted, although oncology health care providers had strong perceptions about the benefits of cancer screening and their ability to get screened, these beliefs do not appear to be related to their knowledge of cancer screening guidelines nor do they have a direct effect on adherence to cancer screening exams. The small, but statistically significant relationship between knowledge and cervical cancer susceptibility and cervical cancer severity was also contrary to what the CHBM and the conceptual model of this study proposed. In this case, both susceptibility and severity slightly decreased when knowledge increased. Although these influences were very small, there may be some value in further exploring whether there is a limit to the yield curve associated with cancer susceptibility and cancer severity at which an increase in knowledge and an understanding of cancer risk factors and ways to reduce risks begins to decrease or have no influence on perceptions of susceptibility and severity related to these diseases. If individuals know the risk factors of a disease and implement risk reduction strategies, would their perception of being susceptible to that disease or their perception of the severity of that disease decrease? Overall, oncology health care professionals were moderately knowledgeable about cancer screening guidelines, and across all three cancer types, average perceptions of susceptibility and severity were low. Additionally, there was minimal to no association between their knowledge of cancer screening guidelines and their perceptions about cancer or cancer screening across all three cancer types.

There was, however, a significant association between perceptions of cervical cancer susceptibility and adherence to cervical cancer screening, specifically as it relates to the HPV test. Increased perceptions of susceptibility to cervical cancer resulted in much higher odds of adhering to HPV testing. Again, although beliefs in being susceptible to cervical cancer were not high in this study population, this CHBM factor should be considered when evaluating HPV adherence in future research studies.

Finally, there was a statistically significant association between the CHBM perceptions of barriers to cancer screening and adherence to cancer screening across all three cancer types. This finding was, perhaps, the most significant finding from this study. As CHBM perceptions of barriers to cancer screening increased for cervical, breast, and colorectal cancer, the odds of adhering to Pap testing, mammography, and colorectal cancer screening tests (i.e., blood stool tests, sigmoidoscopy, and colonoscopy) decreased. As a result, perceptions of barriers to cancer screening, do appear to have a direct effect on the cancer screening adherence of oncology health care professionals. Keeping in mind that the perception of barriers to cancer screening was low in this study population and adherence to cancer screening was high across all three cancer types, this finding may be crucial to answering at least part of the “why” regarding the high adherence rates of this study population. In other words, regardless of their knowledge about cancer screening guidelines, oncology health care professionals in this study did not believe that the barriers to cancer screening were high. Thus, their adherence to cancer screening exams was high. The implications of this finding, however, suggest that if the perception of barriers to cancer screening ever increased for this study population, adherence to cancer screening exams would decrease. Future research should also take

into consideration not only the impact of an individual's actions on the actions of another (i.e., behavior modeling), but the impact of an individual's beliefs on the beliefs and actions of another. Even if many of the CHBM factors do not appear to influence the cancer screening adherence of oncology health care professionals themselves, do their strong beliefs in CHBM factors (i.e., benefits and self-efficacy) influence the cancer screening practices they promote for their family members, patients, or communities?

In documented meta-analyses over the last three decades of the CHBM model and its ability to predict or explain behavior, studies have found the model to be inconsistent. In a 2010 analysis, the researcher found that perceived barriers and perceived benefits were the strongest and most consistent predictors of behavior, perceived severity was only weakly predictive, and perceived susceptibility was unrelated to behavior in the majority of the studies (Carpenter, 2010). More recently, a systematic review of the effectiveness of health belief model interventions in improving adherence was conducted. This included a review of studies where adherence was measured as a behavioral outcome. This review found that the success of intervention on adherence was unrelated to the CHBM constructs that were being measured. Even further, this particular analysis noted that in the only study conducting path analysis, perceived barriers was the only CHBM construct that directly affected adherence to mammography screening (Jones, Smith, & Llewellyn, 2014). As Glanz, Rimer, and Viswanath (2015) note, "…even after all this model's use, we still know relatively little about relationships among CHBM constructs, such as whether they all directly predict behavior or whether some beliefs mediate the relationships to behavior" (p. 89). Clearly, the research study conducted for

this thesis presents further evidence for continued evaluation of the CHBM along with other theoretical models in health behavior research and health psychology.

Finding 2J: There were minimal associations between demographic variables and adherence.

As noted previously, demographic factors were not the focus of this study, but notable associations were observed between age and Pap test adherence and years of service and HPV adherence. Age was associated with Pap test adherence with older age being less likely to adhere, particularly with females greater than or equal to 40 years of age. Similarly, participants with greater than 20 years of service were less likely to adhere to HPV testing. These results are not overly significant, but indicate an opportunity to further explore not only these findings but associations between adherence and other demographic variables. As addressed in the literature review for this study, health disparities exist in early cancer detection and prevention. Perhaps what is most notable about this study is not what was found, but what was not found in this regards. Further analysis of the data from this study and other studies like it should continue to explore whether socio-economic status or the homogeneity of being a member of an oncology health care professional workforce negates health disparities related to cancer screening adherence.

Limitations

There were several limitations to this study and the data analysis conducted. First, since the actual response rate was lower than anticipated, the researcher was unable to estimate with as much precision the confidence intervals that the sample size justification was initially based on. Likewise, the analysis was unable to detect the proposed odds

ratio effect sizes with as much power. Secondly, this study should be interpreted in the context of oncology health care professionals at one academic cancer hospital in the southwestern Unites States. Therefore, the results of this study are not reflective of oncology health care professionals nationwide. Additionally, the response rate of physicians as a sub-context was extremely poor. The professional make-up was heavily skewed toward nursing, advanced practice providers, and other ancillary health care professionals. Thirdly, the demographics of oncology health care professionals at the study institution may not be reflective of demographics within the broader community thus impacting the descriptive comparisons between adherence to cancer screening exams in the study population and adherence in the general public. Furthermore, the cross-sectional research design for this study is not useful in establishing causal relationships or changes in beliefs or behavior over time. As expected, the questions that were administered by this study were limited to self-reported information, which cannot be externally validated. And, as with most self-report surveys, there is a potential for response and social desirability biases, or the tendency of respondents to answer questions in a manner that may be perceived favorably by others. Finally, since the survey was designed to be anonymous, the survey platform could not prevent survey participants from taking the survey more than once if they so desired.

Summary

The purpose of this study was to specifically examine knowledge of cancer screening guidelines as an independent, antecedent variable and factors from the CHBM in the context of oncology health care professionals as a means of explaining adherence to cancer screening guidelines. That is, if adherence of oncology health care professionals

to cancer screening exams are in accordance with recommended cancer screening guidelines, what is the underlying driver or motivator of adherence? Can existing health behavior theories explain this outcome? Hence, the conceptual framework explored by this study was developed through investigational research into the Champion Health Belief Model, as discussed in the literature review. As revealed in this study, oncology health care professionals had a high adherence rate to cancer screening exams for cervical, breast, and colorectal cancer in accordance with recommended cancer screening guidelines. In fact, their adherence rates were arguably higher than reported adherence rates for the general public both locally and nationally. So, was the conceptual framework presented by this study able to explain the high adherence of oncology health care professionals to cancer screening exams?

The results of this research study were mixed. Knowledge had relatively no influence on the CHBM perceptions of susceptibility, severity, barriers, benefits, and self-efficacy. Additionally, the CHBM factors with the strongest belief scores (i.e., benefits and self-efficacy) were not the factors that had an association with cancer screening adherence. On the contrary, direct associations were demonstrated between cancer screening barriers and adherence across all three cancer types. Therefore, the results of this study were not consistent with the parallel mediation model proposed by this study. Instead, the results of this study demonstrated that other interactions between modifying factors, CHBM perceptions, motivational, and experiential factors should be explored.

In fact, per the literature review from this study, since the CHBM is a cognitive based model, it does not consider the emotional component of behavior, where a negative

emotion like fear may significantly influence behavior (Champion & Skinner, 2008). In addition to emotions, the CHBM does not explicitly address social, interpersonal, or contextual issues (Brewer & Rimer, 2008). So, what other experiential factors should be considered? Individuals may be influenced by their previous experiences with cancer screening exams, and whether or not that experience was good or bad. In the context of oncology health care professionals working at a comprehensive cancer center, daily immersion in the care of patients being treated for cancer and interaction with their caregivers may have an emotional component that was not measured by this study. Even further, adherence could also be affected by what health behavior theorists call cues to action.

According to the CHBM. , cues to action have a direct influence on adherence by providing a trigger that prompts an individual's engagement in health behaviors. This factor, however, is the least studied component of the CHBM due to the difficulty in measuring this component without using a true experimental design (i.e., study versus control group). These cues to action, or triggers, may include mass media campaigns; advice from others like support groups; reminders from clinics or primary physicians; the illness of a family member, friend, or perhaps even a patient; or even the influence of literature on cancer screening adherence. For example, when it comes to the comprehensive cancer center examined in this study, the importance of cancer screening exams are heavily promoted at the study institution to a degree that is perhaps unparalleled in the community. Oncology health care professionals are exposed on a regular basis to an intra-community network of cancer preventive messaging that includes institutional reminders about cancer screening, access to professional oncology

conferences, and active community partnerships (e.g., 5K walks/runs, ambassadorships, etc.) focused on the prevention and treatment of cancer. They are surrounded by the visual cues of patients and caregivers dealing with the treatment effects of a cancer diagnosis on a daily basis. In other words, there is a heightened awareness that, although not measured, may be more influential than knowledge of cancer screening guidelines. Again, oncology health care professionals at the study institution demonstrated high adherence to cancer screening exams even though their specific knowledge about the frequency of those screening exams was more deficient.

As previously noted, perceptions of barriers to cancer screening should not be overlooked. For instance, ready access to cancer screening exams could have played a significant role in the high adherence rates of oncology health care professionals as well. The academic cancer center where this study took place has a Cancer Prevention Center that offers on-site cancer screening for several cancer types, including cervical, breast, and colorectal cancer. Although this study did not examine whether or not participants who were adherent to cancer screening exams received their screening at the study institution, lack of ready access to cancer screening is an acknowledged barrier in the community. In addition, access to health insurance coverage for cancer screening, which is provided to all eligible employees at the study institution, also eliminates another known barrier to cancer screening that may differentiate this population from the general public. If a robust program is in place that provides ready access to cancer screening exams, health care coverage through employer based health insurance plans, and cues to action about preventive cancer screening, then memorization of the specific frequencies of cancer screening exams may not be necessary in order for adherence to be high.

Therefore, although not measured by this study, cues to action, coupled with low perceptions of barriers to cancer screening, may have factored into the uniqueness of this study population and significantly influenced their high adherence rates. As a result, future recommendations for research include exploring the interaction between modifying factors, CHBM variables, experiential factors, and cues to action. For instance, oncology health care professionals in this study had strong beliefs about the benefits of cancer screening and their ability to get screened for cancer. Although these beliefs had no direct effect on adherence, could these factors have possibly decreased the perception of barriers to cancer screening, which did have a direct effect on adherence? What about cues to action? The existing theoretical model posits that cues to action may have a direct effect on adherence. But, could cues to action also have an influence on CHBM beliefs? Could cues to action, like the aforementioned visual cues, have possibly influenced perceptions about the benefits of cancer screening or perceptions about one's ability to get screened? Could experiential factors like past experiences with cancer screening exams influence one's perception about cancer screening? In other words, instead of a parallel mediation model between select factors like knowledge, the CHBM, and adherence, does this study reveal a more complex interaction between multiple factors and adherence similar to Figure 3 below?

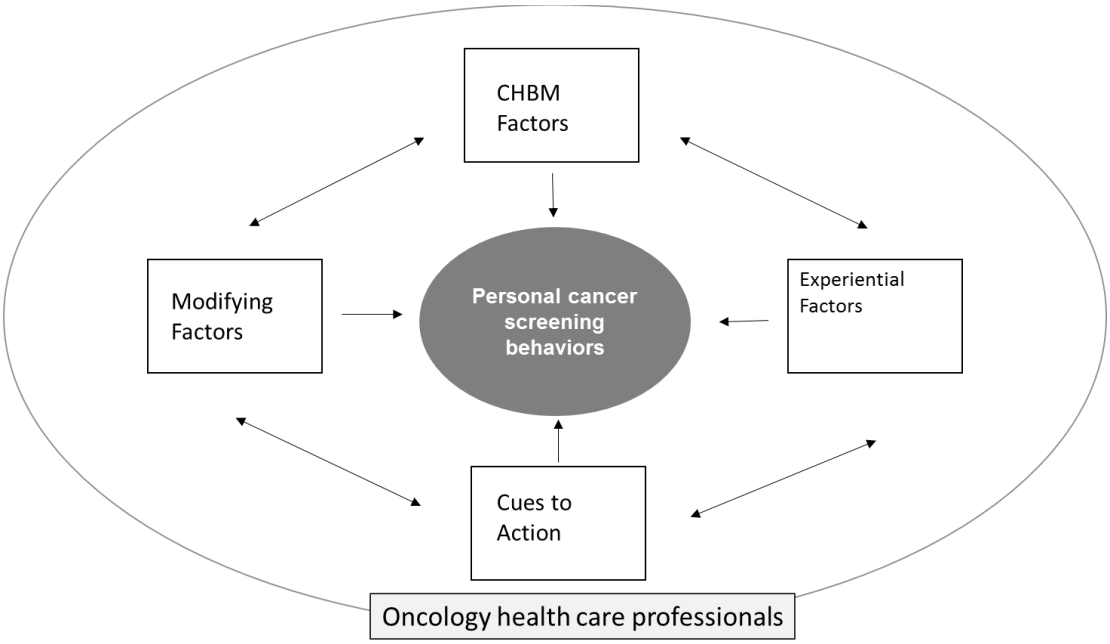

Figure 3. Revised conceptual framework.

Health care professionals, in general, offer an interesting perspective in health education because they are both promoters and consumers of health education. Similarly, oncology health care professionals are both promoters and consumers of cancer prevention education. This research study was unique in its exploration of cancer screening beliefs and behaviors in cancer health professionals in an effort to probe the factors that most influence their own adherence to cancer screening exams. Additionally, employee health surveys are sorely lacking in organizations that provide health services as a product. This baseline survey of cancer screening knowledge, beliefs, and behaviors at a comprehensive cancer center and similar baseline studies of health behaviors should be replicated at other academic cancer centers and health care institutions to gauge the depth of health care knowledge, beliefs, practices, and behaviors of employees. Future research should continue to explore the interactions between multiple factors and adherence as it pertains to health behavior.

References

Abrams, D. B. (1997). *A new agenda for cancer control research: Report of the cancer control review group*. Retrieved from National Cancer Institute at https://deainfo.nci.nih.gov/advisory/bsa/bsa_program/bsacacntrlmin.pdf

Abramson, S., Stein, J., Schaufele, M., Frates, E., & Rogan, S. (2000). Personal exercise habits and counseling practices of primary care physicians: A national survey. *Clinical Journal of Sport Medicine, 10*, 40-48. https://doi.org/10.1097%2F00042752-200001000-00008

Aho, W. R. (1979). Participation of senior citizens in the Swine Flu inoculation program: An analysis of Health Belief Model variables in preventive health behavior. *Journal of Gerontology, 34,* 201-208. https://doi.org/10.1093%2Fgeronj%2F34.2.201

Ajzen, I. (2012). The theory of planned behavior. In P. Van Lange, A. Kruglanski, & E. Higgins (Ed.), *The handbook of theories of social psychology* (pp. 438-459). Thousand Oaks, CA: Sage.

Ali, N. S. (2008). Prediction of coronary heart disease preventive behaviors in women: A test of the health belief model. *Women and Health, 35(*1), 83-96. http://dx.doi.org/10.1300/J013v35n01_06

American Cancer Society. (2014a). *Breast Cancer* [Brochure]. Retrieved from http://www.cancer.org/cancer/breastcancer/detailedguide/breast-cancer-key-statistics

American Cancer Society. (2014b). *Cervical Cancer* [Brochure]. Retrieved from http://www.cancer.org/cancer/cervicalcancer/detailedguide/cervical-cancer-key-statistics

American Cancer Society. (2014c). *Early history of cancer*. Retrieved from http://www.cancer.org/cancer/cancerbasics/thehistoryofcancer/the-history-of-cancer-what-is-cancer

American Cancer Society. (2016a). *Cancer Facts & Figures 2016.* Retrieved from http://www.cancer.org/research/cancerfactsstatistics/cancerfactsfigures2016/index

American Cancer Society. (2016b). *What are the key statistics about cervical cancer?* Retrieved from http://www.cancer.org/cancer/cervicalcancer/detailedguide/cervical-cancer-key-statistics

American Cancer Society. (2018). *Cancer Prevention and Early Detection Facts and Figures* [Brochure]. Retrieved from https://www.cancer.org/research/cancer-facts-statistics/all-cancer-facts-figures/cancer-facts-figures-2018.html

American Society of Clinical Oncology. (2016). Guidelines, tools, and resources. Retrieved from http://www.asco.org/practice-guidelines/quality-guidelines/guidelines

Applebaum, E., Ruhlen, T. N., Kronenberg, F. R., Hayes, C., & Peters, E. S. (2008). Oral cancer knowledge, attitudes, and practices: A survey of dentists and primary care physicians in Massachusetts. *The Journal of the American Dental Association, 140(*4), 461-467. http://dx.doi.org/10.14219/jada.archive.2009.0196

Armitage, C. J., & Conner, M. (2000). Social cognition models and health behavior: A structured review. *Psychology and Health, 15(2*), 173-189. http://dx.doi.org/10.1080/08870440008400299

Ashford, A., Gemson, D., Sheinfeld-Gorin, S. N., Bloch, S., Lantigua, R., Ahsan, H., & Neugut, A. I. (2000). Cancer screening and prevention practices of inner- city physicians. *American Journal of Preventive Medicine, 19(*1), 59-62. http://dx.doi.org/10.1016/S0749-3797(00)00152-5

Austin, L. T., Ahmad, F., McNally, M. J., & Stewart, D. E. (2002). Breast and cervical cancer screening in Hispanic women: a literature review using the health belief model. *Women's Health Issues, 12(*3), 122-128. Retrieved from http://www.sciencedirect.com/science/article/pii/S1049386702001329

Autier, P., Esserman, L., Flowers, C., & Houssami, N. (2012). Breast cancer screening: The questions answered. *National Review of Clinical Oncology, 9(*10), 599-605. https://doi.org/10.1038%2Fnrclinonc.2012.126

Bandura, A. (1961). Identification as a process of incidental learning. *Journal of Abnormal and Social Psychology, 63(*2), 311-318. https://doi.org/10.1037%2Fh0040351

Bandura, A. (1997). *Self -efficacy: The exercise of control*. New York, NY: W.H. Freeman

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education and Behavior, 31(*2), 143-164. https://doi.org/10.1177%2F1090198104263660

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51(*6), 1173-1182. http://dx.doi.org/10.1037/0022-3514.51.6.1173

Becker, M. H. (1974). The Health Belief Model and personal health behavior. *Health Education Monographs, 2, 324-473.* https://doi.org/10.1177%2F109019817400200407

Becker, M. H., Haefner, D. P., Kasl, S. V., Kirscht, J. P., Maiman, L. A., & Rosenstock, I. M. (1977). Selected psychosocial models and correlates of individual health-related behaviors. *Medical Care, 15(*5), 27-46. Retrieved from http://www.jstor.org/stable/3763352

Berkanovic, E. (1976). Behavioral science and prevention. *Preventive Medicine, 5, 92-105*. https://doi.org/10.1016%2F0091-7435%2876%2990013-x

Biesheuvel, C., Barratt, A., Howard, K., Houssami, N., & Irwig, L. (2007). Effects of study methods and biases on estimates of invasive breast cancer overdetection with mammography screening: A systematic review. *Lancet Oncology, 8(*12), 1129-1138. https://doi.org/10.1016%2Fs1470-2045%2807%2970380-7

Bish, A., Sutton, S., & Golombok, S. (2000). Predicting uptake of a routine cervical smear test: A comparison of the health belief model and the theory of planned behavior. *Psychology and Health, 15*, 35-50. http://dx.doi.org/10.1080/08870440008400287

Black, B., Marcoux, B. C., Stiller, C., Qu, X., & Gellish, R. (2012). Personal health behaviors and role-modeling attitudes of physical therapists and physical therapist students: A cross-sectional study. *Physical Therapy, 92(*11), 1419-1436. https://doi.org/10.2522%2Fptj.20110037

Bloom-Cerkoney, K. A., & Hart, L. K. (1980). The relationship between the health belief model and compliance of persons with diabetes mellitus. *Diabetes Care, 3(*5), 594-598. http://dx.doi.org/10.2337/diacare.3.5.594

Brandt, H. M., Dolinger, H. R., Sharpe, P. A., Hardin, J. W., & Berer, F. G. (2012). Relationship of colorectal cancer awareness and knowledge with colorectal cancer screening. *Colorectal Cancer, 1(*5), 383-396. https://doi.org/10.2217%2Fcrc.12.45

Brawarsky, P., Brooks, D. R., Mucci, L. A., & Wood, P. A. (2004) Effect of physician recommendation and patient adherence on rates of colorectal cancer testing. *Cancer Detection and Prevention, 28(*4), 260-268. https://doi.org/10.1016%2Fj.cdp.2004.04.006

Breslow, L., Agran, L., Breslow, D. M., Morganstern, M., & Ellwein, L. (1977). Cancer control: Implications from its history. *Journal of the National Cancer Institute, 59*, 671-686. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/328911

Bretthauer, M. & Kalager, M. (2013). Principles, effectiveness, and caveats in screening for cancer. *British Journal of Surgery, 100(*1), 55-65. https://doi.org/10.1002%2Fbjs.8995

Brewer, N. T., & Rimer, B. K. (2008). Perspectives on health behavior theories that focus on individuals. In Glanz, K., Rimer, B. K., & Viswanath, K. (4th ed.), *Health behavior and health education: Theory, research, and practice* (pp. 149-165). San Francisco, CA: Jossey-Bass.

Cabana, M. D., Rand, C. S., Powe, N. R., Wu, A. W., Wilson, M. H., Abboud, P. C., & Rubin, H. R. (1999). Why don't physicians follow clinical practice guidelines: A framework for improvement. *Journal* of the American Medical Association, *282(*15), 1458-1465. https://doi.org/10.1001/jama.282.15.1458

Cancer Prevention Research Institute of Texas. (2012). *Texas Cancer Plan 2012.* Retrieved from http://canceralliance oftexas.org/

Cancer Prevention Research Institute of Texas. (2015). *An economic assessment of the cost of cancer in Texas and the benefits of the Cancer Prevention and Research Institute of Texas (CPRIT) and its programs: 2015 update.* Retrieved from http://www.cprit.state.tx.us/about-cprit/reports/

Carpenter, C. J. (2010). A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Communication, (25*)8, 661-669. https://doi.org/10.1080%2F10410236.2010.521906

Carter, S. M., Williams, J., Parker, L., Pickles, K., Jacklyn, G., Rychetnik, L., & Barratt, A. (2015). Screening for cervical, prostate, and breast cancer: Interpreting the evidence. *American Journal of Preventive Medicine, 49(*2), 274-285. https://doi.org/10.1016%2Fj.amepre.2015.01.009

Centers for Disease Control and Prevention. (2012). Cancer screening – United States. *Morbidity and Mortality Weekly Report, 61(*3), 41-45. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6103a1.htm

Centers for Disease Control and Prevention. (2013a). *Use of colorectal tests or procedures among adults aged 50-75, by selected characteristics: United States, selected years 2000-2010.* Retrieved from http://www.cdc.gov/nchs/data/hus/2013/085.pdf

Centers for Disease Control and Prevention. (2013b). *Use of pap smears among women aged 18 and over, by selected characteristics: United States, selected years 1987-2010.* Retrieved from http://www.cdc.gov/nchs/hus/contents2013.htm#084

Centers for Disease Control and Prevention. (2015). Behavioral risk factor surveillance system. Retrieved from http://www.cdc.gov/brfss/about/brfss_faq.htm

Centers for Disease Control and Prevention. (2015, December 8). National comprehensive cancer control program. Retrieved January 14, 2016, from http://www.cdc.gov/cancer/ncccp/index.htm

Centers for Disease Control and Prevention. (2016). *Behavioral risk factor surveillance system survey questionnaire*. Atlanta, GA: U. S. Department of Health and Human Services, Centers for Disease Control and Prevention. Retrieved from https://www.cdc.gov/brfss/

Centers for Disease Control and Prevention. (2016, January 4). The global burden of cancer. Retrieved March 16, 2016, from http://www.cdc.gov/cancer/international/burden.htm

Champion, V. (1984). Instrument development for health belief model constructs. *Advances in Nursing Science, 6(3*), 73-85. https://doi.org/10.1097%2F00012272-198404000-00011

Champion, V. (1999). Revised susceptibility, benefits, and barriers scale for mammography screening. *Research in Nursing & Health, 22,* 341-348. https://doi.org/10.1002/(sici)1098-240x(199908)22:4%3C341::aid-nur8%3E3.3.co;2-g

Champion, V. L., & Skinner, C. S. (2008). The health belief model. In Glanz, K., Rimer, B. K., & Viswanath, K. (4th ed.), *Health behavior and health education: Theory, research, and practice (*pp. 45-65). San Francisco, CA: Jossey-Bass.

Champion, V., Skinner, C. S., & Menon, U. (2005). Development of a self-efficacy scale for mammography. *Research in Nursing & Health, 28,* 329-336. https://doi.org/10.1002%2Fnur.20088

Chevan, J., & Haskvitz, E. M. (2010). Do as I do: Exercise habits of physical therapists, physical therapist assistants, and student physical therapists. *Physical Therapy, 90(*5), 727-734. https://doi.org/10.2522%2Fptj.20090112

Chew, F., Palmer, S., Slonska, Z., & Subbiah, K. (2002). Enhancing health knowledge, health beliefs, and health behavior in Poland through a health promoting television program series. *Journal of Health Communication, 7(*3), 179-196. https://doi.org/10.1080%2F10810730290088076

Codori, A. M., Petersen, G. M., Mighoretti, D. L., & Boyd, P. (2001). Health beliefs and endoscopic screening for colorectal cancer: Potential for cancer prevention. *Preventive Medicine, 33(*2), 128-136. https://doi.org/10.1016%2Fs0091-7435%2801%2980009-8

Coleman-Wallace, D. A., Baltrus, P. T., Wallace, T. C., Blumenthal, D. S., & Rust, G. S. (2013). Black white disparities in receiving a physician recommendation for colorectal cancer screening and reasons for not undergoing screening. *Journal of Health Care Poor Underserved, 24(*3), 1115-1124. https://doi.org/10.1353%2Fhpu.2013.0132

Conner, M., & Norman, P. (1994). Comparing the Health Belief Model and the Theory of Planned Behavior in health screening. In Rutter, D. R., & Quine, L. (Eds.), *Social Psychology and Health: European Perspectives.* Aldershot, UK: Avebury

Contento, I. R., Randell, J. S., & Basch, C. E. (2002). Review and analysis of evaluation measures used in nutrition education intervention research. *Journal of Nutrition Education and Behavior, 34(*1), 2-25. https://doi.org/10.1016%2Fs1499-4046%2806%2960220-0

Coughlin, S. S., & Thompson, T. (2005). Physician recommendation for colorectal cancer screening by race, ethnicity, and health insurance status among men and women in the United States. *Health Promotion Practice, 6(*4), 369-378. https://doi.org/10.1177%2F1524839905278742

Cummings, E. M., Jette, A. M., Brock, B. M., & Haefner, D. P. (1979). Psychosocial determinants of immunization behavior in a swine influenza campaign. *Medical Care, 17*, 639-649. https://doi.org/10.1097%2F00005650-197906000-00008

Dangi-Garamella, S. (2016). Updated USPSTF breast cancer screening guidelines remain controversial. *American Journal of Managed Care.* Retrieved from http://www.ajmc.com/newsroom/updated-uspstf-breast-cancer-screening-guidelines-remain-controversial

De Leeuw, E. D., Hox, J. J., & Dillman, D. A. (Eds.). (2008). *International handbook of survey methodology.* New York, NY: Lawrence Erlbaum Associates.

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method (4th ed.).* Hoboken, NJ: John Wiley & Sons, Inc.

DiClemente, C. C., Prochaska, J. O., & Gilbertini, M. (1985). Self-efficacy and the stages of self-change of smoking. *Cognitive Therapy & Research, 9(*2), 181-200. https://doi.org/10.1007%2Fbf01204849

Epstein, R. M., & Street, R. L. (2011). The values and value of patient-centered care. *Annals of Family Medicine, 9(*2), 100-103. https://doi.org/10.1370%2Fafm.1239

Fahimi, M., Link, M., Mokdad, A., Schwartz, D. A., & Levy, P. (2008). Tracking chronic disease and risk behavior prevalence as survey participation declines: Statistics from the Behavioral Risk Factor Surveillance System and other national surveys. *Preventing Chronic Disease, 5(*3), A80. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2483564/

Felix, J. C., Lacey, M. J., Miller, J. D., Lenhart, G. M., Spitzer, M., & Kulkarni, R. (2016). The clinical and economic benefits of co-testing versus primary HPV testing for cervical cancer screening: A modeling analysis. *Journal of Women's Health, 25(*6), 606-616. https://doi.org/10.1089%2Fjwh.2015.5708

Ferrante, J. M., Winston, D. G., Chen, P. H., & de la Torre, A. N. (2008). Family physicians' knowledge and screening of chronic hepatitis and liver cancer. *Family Medicine, 40(*5), 345-351. Retrieved from https://www.researchgate.net/profile/Jeanne_Ferrante2/publication/5386936_Family_physicians'_knowledge_and_screening_of_chronic_hepatitis_and_liver_cancer/links/00b495398be84ae88d000000.pdf

Field, M. J., & Lohr, K. N. (Eds.). (1990). *Clinical practice guidelines: Directions for a new program.* Washington, D.C.: National Academy Press.

Fiscella, K., Franks, P., Gold, M. R., & Clancy, C. M. (2000). Inequality in quality: Addressing socioeconomic, racial, and ethnic disparities in health care. *Journal of the American Medical Association, 283(*19), 2579-2584. https://doi.org/10.1001%2Fjama.283.19.2579

Frank, E. (2004). Physician health and patient care. *Student Journal of the American Medical Association, 291(*5): 637. https://doi.org/10.1001%2Fjama.291.5.637

Frank, E., Biola, H. & Burnett, C. A. (2000). Mortality rates and causes among US physicians. *American Journal of Preventive Medicine, 19(*3), 155-159. https://doi.org/10.1016%2Fs0749-3797%2800%2900201-4

Frank, E., Breyan, J., & Elon, L. (2000). Physician disclosure of healthy personal behaviors improves credibility and ability to motivate. *Archives of Family Medicine, 9*(3), 287-290. http://dx.doi.org/10.1001/archfami.9.3.287

Frank, E., Brogan, D. J., Mokdad, A. H., Simoes, E. J., Kahn, H. S., & Greenberg, R. S. (1998). Health-related behaviors of women physicians vs other women in the United States. *Archives of Internal Medicine, 158*(4), 342-348. https://doi.org/10.1001%2Farchinte.158.4.342

Frank, E., Dresner, Y., Shani, M., & Vinker, S. (2013). The association between physicians' and patients' preventive health practices. *Canadian Medical Association Journal, 185*(8), 649-653. https://doi.org/10.1503/cmaj.121028

Frank, E., Rothenberg, R., Lewis, C., & Belodoff, B. F. (2000). Correlates of physicians' prevention-related practices. *Archives of Family Medicine, 9,* 359-367. https://doi.org/10.1001/archfami.9.4.359

Frank, E., Wright, E. H., Serdula, M. K., Elon, L. K., & Baldwin, G. (2002). Personal and professional nutrition-related practices of US female physicians. *American Journal of Clinical Nutrition, 75,* 326-332. Retrieved from http://www.ajcn.nutrition.org

Fulton, J. P., Buechner, J. S., Scott, H. D., DeBuono, B. A., Feldman, J. P., Smith, R. A., & Kovenock, D. (1991). A study guided by the Health Belief Model of the predictors of breast cancer screening of women ages 40 and older. *Public Health Reports, 106(*4), 410-420. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1580256/

Gennarelli, M., Jandorf, L., Cromwell, C., Valdimarsdottir, H., Redd, W., & Itzkowitz, S. (2005). Barriers to colorectal cancer screening: Inadequate knowledge by physicians. *The Mount Sinai Journal of Medicine, 72(*1), 36-44. Retrieved from http://europepmc.org/abstract/med/15682261

Gillam, S. J. (1991). Understanding the uptake of cervical cancer screening: The contribution of the health belief model. *British Journal of General Practice, 41,* 510-513. Retrieved from http://bjgp.org/content/41/353/510.short

Glanz, K. (1982). Preventive health behavior of physicians. *Journal of Medical Education, 57(*8), 637-639. Retrieved from http://journals.lww.com/academicmedicine/Abstract/1982/08000/Preventive_health_behavior_of_physicians.11.aspx

Glanz, K., & Bishop, D. B. (2010). The role of behavioral science theory in development and implementation of public health interventions. *Annual Review of Public Health, 31,* 399-418. https://doi.org/10.1146%2Fannurev.publhealth.012809.103604

Glanz, K., Rimer, B. K., & Viswanath, K. (2008). *Health behavior and health education: Theory, research, and practice* (4th ed.). San Francisco, CA: Jossey-Bass.

Glanz, K., Rimer, B. K., & Viswanath, K. (2015). *Health behavior: Theory, research, and practice* (5th ed.). San Francisco, CA: Jossey-Bass.

Greenwald, P., & Cullen, J. W. (1985). The new emphasis in cancer control. *Journal of the National Cancer Institute, 74(*3), 543-551. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/3883037

Gross, C. P., Mead, L. A., Ford, D. E., & Klag, M. J. (2000). Physician, heal thyself? Regular source of care and use of preventive health services among physicians. *Archives of Internal Medicine, 160(*21), 3209-3214. https://doi.org/10.1001/archinte.160.21.3209

Gracey, D., Stanley, N., Burkey, V., Corti, B., & Beilin, L. J. (1995). Nutritional knowledge, beliefs, and behaviors in teenage school students. *Health Education Research, 11(*2), 187-204. https://doi.org/10.1093/her/11.2.187

Gurmankin, A., Baron, J., Hershey, J., & Ubel, P. (2002). The role of physicians' recommendations in Medical Treatment Decisions. *Medical Decision Making, 22*(3), 262-271. https://doi.org/10.1177/0272989x0202200314

Guvenc, G., Akyuz, A., & Acikel, C. H. (2011). Health belief model scale for cervical cancer and Pap smear test: Psycometric testing. *Journal of Advanced Nursing, 67(*2), 428-437. https://doi.org/10.1111/j.1365-2648.2010.05450.x

Haas, J. S., Sprague, B. L., Klabunde, C. N., Tosteson, A. N., Chen, J. S., Bitton, A.,…Schapira, M. M. (2016). Provider attitudes and screening practices following changes in breast and cervical cancer screening guidelines. *Journal of General Internal Medicine, 31(*1), 52-59. https://doi.org/10.1007/s11606-015-3449-5

Haefner, D. P., & Kirscht, J. P. (1970). Motivational and behavioral effects of modifying health beliefs. *Public Health Reports, 85(*6), 478-484. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2031729/?page=6

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap) - A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomed Informatics, 42(*2), 377-381. https://doi.org/10.1016/j.jbi.2008.08.010

Harrison, J. A., Mullen, P. D., & Green, L. W. (1992). A meta-analysis of studies of the Health Belief Model with adults. *Health Education Research: Theory and Practice, 7(*1), 107-116. https://doi.org/10.1093/her/7.1.107

Hash, R. B., Munna, R. K., Vogel, R. L., & Bason, J. J. (2003). Does physician weight affect perception of health advice? *Preventive Medicine, 36(*1), 41-44. https://doi.org/10.1006/pmed.2002.1124

Haynes, B. R., Taylor, W. R., & Sackett, D. L. (1979). *Adherence in health care.* Baltimore, MD: Johns Hopkins University Press.

Helfand, B. K., & Mukamal, K. J. (2013). Healthcare and lifestyle practices of healthcare workers: Do healthcare workers practice what they preach? *The Journal of the American Medical Association Internal Medicine, 173*(3), 242-244. https://doi.org/10.1001/2013.jamainternmed.1039

Hiatt, R. A., & Rimer, B. K. (1999). A new strategy for cancer control research. *Cancer Epidemiology Biomarkers and Prevention, 8(*11), 957-964. Retrieved from http://cebp.aacrjournals.org/content/8/11/957

Hicks, M. L., Yap, O. S., Matthews, R., & Parham, G. (2006). Disparities in cervical cancer screening, treatment and outcomes. *Ethnicity and Disease, 16(*3), 63-66. Retrieved from http://www.ishib.org/ED/journal/16-2s3/ethn-16-2s3-63.pdf

Hill, D., Gardner, G., & Rassaby, J. (1985). Factors predisposing women to take precautions against breast and cervix cancer. *Journal of Applied Social Psychology, 15(1*), 59-79. https://doi.org/10.1111/j.1559-1816.1985.tb00894.x

Hofstetter, C. R., Sallis, J. F., & Hovell, M. F. (1990). Some health dimensions of self-efficacy: Analysis of theoretical specificity. *Social Science Medicine, 31(*9), 1051-1056. https://doi.org/10.1016/0277-9536(90)90118-c

Hu, S. S., Pierannunzi, C., & Balluz, L. (2011). Integrating a multimode design into a national random-digit-dialed telephone survey. *Preventing Chronic Disease, 8(*6), A145. Retrieved from http://ga6zr9ch7u.scholar.serialssolutions.com/?sid=google&auinit=SS&aulast=Hu&atitle=Peer+Reviewed:+Integrating+a+Multimode+Design+Into+a+National+Random-Digit%E2%80%93Dialed+Telephone+Survey&id=pmid:22005638

Jacobs, L. A. (2002). Health beliefs of first-degree relatives of individuals with colorectal cancer and participation in health maintenance visits: A population-based survey. *Cancer Nursing, 25(4*), 251-265. Retrieved from http://journals.lww.com/cancernursingonline/Abstract/2002/08000/Health_Beliefs_of_First_degree_Relatives_of.1.aspx

Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A decade later. *Health Education & Behavior, 11(*1), 1-47. https://doi.org/10.1177/109019818401100101

Jerant, A. F., Fenton, J. J., & Franks, P. (2008). Determinants of racial/ethnic colorectal cancer screening disparities. *Archives of Internal Medicine, 168(*12), 1317-1324. https://doi.org/10.1001/archinte.168.12.1317

Jones, C. J., Smith, H., & Llewellyn, C. (2014). Evaluating the effectiveness of health belief model interventions in improving adherence: A systematic review. *Health Psychology Review, 8(3*), 253-269. http://dx.doi.org/10.1080/17437199.2013.802623

Jones, C. L., Jensen, J. D., Scherr, C. L., Brown, N. R., Christy, K., & Weaver, J. (2014). The health belief model as an explanatory framework in communication research: Exploring parallel, serial, and moderated mediation. *Health Communication, 30(*6), 566-576. https://doi.org/10.1080/10410236.2013.873363

Kegeles, S. S. (1963). Why people seek dental care: A test of a conceptual formulation. *Journal of Health and Human Behavior, 4(*3), 166-173). Retrieved from http://www.jstor.org/stable/2948658

Kirsner, R. S., Muhkerjee, S., & Federman, D. G. (1999). Skin cancer screening in primary care: Prevalence and barriers. *Journal of the American Academy of Dermatology, 41(*4), 564-56. https://doi.org/10.1016/s0190-9622(99)80053-x

Klabunde, C. N., Frame, P. S., Meadow, A., Jones, E., Nadel, M., & Vernon, S. W. (2003). A national survey of primary care physicians' colorectal cancer screening recommendations and practices. *Preventive Medicine, 36(*3), 352-362. http://dx.doi.org/10.1016/S0091-7435(02)00066-X

Kreuter, M. W., Chheda, S. G., & Bull, F. C. (2009). How does physician advice influence patient behavior? Evidence for a priming effect. *Archives of Family Medicine*, 9, 426-433. https://doi.org/10.1001/archfami.9.5.426

Lambert, C. C., Chandler, R., McMillan, S., Kromrey, J., Johnson-Mallard, V., & Kurtyka, D. (2015). Pap test adherence, cervical cancer perceptions, and HPV knowledge among HIV infected women in a community health setting. *Journal of the Association of Nurses in AIDS care, 26(*3), 271-280. https://doi.org/10.1016/j.jana.2014.11.007

Lee, C. H., Dershaw, D. D., Kopans, D., Evans, P., Monsees, B., Monticciolo, D.,…Burhenne, L. W. (2010). Breast cancer screening with imaging: Recommendations from the society of breast imaging and the ACR on the use of mammography, breast MRI, breast ultrasound, and other technologies for the detection of clinically occult breast cancer. *Journal of the American College of Radiology, 7(*1), 18-27. https://doi.org/10.1016/j.jacr.2009.09.022

Lee, J., Gordon, P. B., & Whitman, G. J. (2015). "Do unto others as you would have them do unto you": Breast imagers' perspectives regarding screening mammography for others and for themselves – Do they practice what they preach? *American Journal of Roentgenology, 204,* 1336-1344. https://doi.org/10.2214/ajr.14.13237

Levin, T. R., Jamieson, L., Burley, D. A., Reyes, J., Oehrli, M., & Caldwell, C. (2011). Organized colorectal cancer screening in integrated health care systems. *Epidemiologic Reviews, 33,* 101-110. https://doi.org/10.1093/epirev/mxr007

Lewis, C. E., Wells, K. B., & Ware, J. (1986). A model for predicting the counseling practices of physicians. *Journal of General Internal Medicine, 1*(1), 14-19. https://doi.org/10.1007/bf02596319

Li, C., Balluz, L. S., Ford, E. S., Okoro, C. A., Zhao, G., & Pierannunzi, C. (2012). A comparison of prevalence estimates for selected health indicators and chronic diseases or conditions from the Behavioral Risk Factor Surveillance System, the National Health Interview Survey, and the National Health and Nutrition Examination Survey, 2007-2008. *Preventive Medicine, 54(*6), 381-387. https://doi.org/10.1016/j.ypmed.2012.04.003

Livaudis, J. C., Kaplan, C. P., Haas, J. S., Perez-Stable, E. J., Stewart, S., & Des Jarlais, G. (2005). Lifestyle behavior counseling for women patients among a sample of California physicians. *Journal of Women's Health, 14(*6), 485-495. https://doi.org/10.1089/jwh.2005.14.485

Lo, S. W., Chair, S. Y., & Lee, F. K. (2015). Factors associated with health-promoting behavior of people with or at high risk of metabolic syndrome: Based on the health belief model. *Applied Nursing Research, 28(*2), 197-201. https://doi.org/10.1016/j.apnr.2014.11.001

MacBride, M. B., Pruthi, S., & Bevers, T. (2012). The evolution of breast self-examination to breast awareness. *The Breast Journal, 18*: 641-643. https://doi.org/10.1111/tbj.12023

Macrae, F. A., Hill, D. J., St. John, D. J., Ambikapathy, A., Garner, J. F., & the Ballarat General Practitioner Research Group. Predicting colon cancer screening behavior from health beliefs. *Preventive Medicine,* 13, 115-126. https://doi.org/10.1016/0091-7435(84)90044-6

Maibach, E., & Murphy, D. A. (1995). Self-efficacy in health promotion research and practice: conceptualization and measurement. *Health Education Research, 10(*1), 37-50. https://doi.org/10.1093/her/10.1.37

Mariotto, A. B., Yabroff, K. R., Shao, Y., Feuer, E. J., & Brown, M. L. (2011). Projections of the Cost of Cancer Care in the U.S.: 2010-2020. *Journal of the National Cancer Institute, 103*(2), 117-128. https://doi.org/10.1093/jnci/djq495

McFarland, D. M. (2003). Cervical cancer and pap smear screening in Botswana: Knowledge and perceptions. *International Nursing Review, 50(*3), 167-175. https://doi.org/10.1046/j.1466-7657.2003.00195.x

McKinlay, J. B., & Marceau, L. D. (2000). Upstream health public policy: Lessons from the battle of tobacco. *International Journal of Health Services, 30(*1), 49-69. https://doi.org/10.2190/2v5h-rhbr-ftm1-kgcf

McNerney, J. P., Andes, S., & Blackwell, D. L. (2007). Self-reported health behaviors of osteopathic physicians. *Journal of American Osteopathic Association, 107(*12), 537-546. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.860.5929&rep=rep1&type=pdf

McPeake, J., Bateson, M., & O'Neill, A. (2014). Electronic surveys: How to maximize success. *Nurse Researcher, 21(*3), 24-26. https://doi.org/10.7748/nr2014.01.21.3.24.e1205

McPhee, S. J., Richard, R. J., & Solkowitz, S. N. (1986). Performance of cancer screening in a university General Internal Medicine practice: Comparison with the 1980 American Cancer Society guidelines. *Journal of General Internal Medicine, 1(*5), 275-281. https://doi.org/10.1007/bf02596202

Meissner, H. I., Potosky, A. L., & Convissor, R. J. (1992). How sources of health information relate to knowledge and use of cancer screening exams. *Journal of Community Health, 17(*3), 153-165. https://doi.org/10.1007/bf01324404

Mikhail, B. (1981). The health belief model: A review and critical evaluation of the model, research, and practice. *Advances in Nursing Science, 4(*1), 65-82. Retrieved from http://journals.lww.com/advancesinnursingscience/citation/1981/10000/the_health_belief_model__a_review_and_critical.7.aspx

Miok, L. (2000). Knowledge, barriers, and motivators related to cervical cancer screening among Korean-American women: A focus group approach. *Cancer Nursing, 23(*3), 168-175. Retrieved from http://journals.lww.com/cancernursingonline/Abstract/2000/06000/Knowledge,_Barriers,_and_Motivators_Related_to.3.aspx

Moritz, S. E., Feltz, D. L., Fahrbach, K. R., & Mack, D. E. (2013). The relation of self-efficacy measures to sport performance: A meta-analytic review. *Research Quarterly for Exercise and Sport, 71(*3), 280-294. http://dx.doi.org/10.1080/02701367.2000.10608908

Moser, R. P., Naveed, S., Cantor, D., Blake, K. D., Rutten, L. J., Ramirez, A. S., …Yu, M. (2013). Health information national trends survey: Integrative analytic methods using population-level cross-sectional data. Retrieved from https://hints.cancer.gov/docs/HINTS_IDA_Report.pdf

Moyer, V. A. (2012). Screening for cervical cancer: U. S. Preventive Services Task Force recommendation statement. *Annals of Internal Medicine, 156*(12), 880-892. https://doi.org/10.7326/0003-4819-156-12-201206190-00424

Mullen, P. D., Hersey, J. C., & Iverson, D. C. (1987). Health behavior models compared. *Social Science & Medicine, 24(*11), 973-981. https://doi.org/10.1016/0277-9536(87)90291-7

National Cancer Institute. (2015). History of the National Cancer Institute. Retrieved from http://www.cancer.gov/about-nci/overview/history

National Cancer Institute. (2016). National cancer moonshot initiative. Retrieved from http://www.cancer.gov/research/key-initiatives/moonshot-cancer-initiative/blue-ribbon-panel

National Cancer Institute. (2017). Health Information National Trends Survey. Retrieved from https://hints.cancer.gov/instrument.aspx

National Center for Chronic Disease Prevention and Health Promotion, Division of Cancer Prevention and Control. (2014). BRFSS statistical brief on cancer screening questions. Retrieved from https://www.cdc.gov/brfss/data_documentation/pdf/2014_brfss-statistical-brief_cancer.pdf

Nelson, A. (2002). Unequal treatment: Confronting racial and ethnic disparities in health care. *Journal of the National Medical Association, 94(*8), 666-668. https://doi.org/10.5860/choice.40-5843

Nelson, D., Kreps, G., Hesse, B., Croyle, R., Willis, G., Arora, N., …Alden, S. (2004). The Health Information National Trends Survey (HINTS): Development, design, and dissemination. *Journal of Health Communication, 9(5*), 443-460. https://doi.org/10.1080/10810730490504233

Nelson, D. E., Powell-Griner, E., Town, M., & Kovar, M. G. (2003). A comparison of national estimates from the National Health Interview Survey and the Behavioral Risk Factor Surveillance System. *American Journal of Public Health, 93(*8), 1335-1341. Retrieved from http://ga6zr9ch7u.scholar.serialssolutions.com/?sid=google&auinit=DE&aulast=Nelson&atitle=A+comparison+of+national+estimates+from+the+national+health+interview+survey+and+the+behavioral+risk+factor+surveillance+system&id=pmid:12893624

Nelson, H. D., Cantor, A., Humphrey, L., Fu, R., Pappas, M., Daeges, M., & Griffin, J. (2016). Screening for breast cancer: A systematic review to update the 2009 U.S. Preventive Services Task Force recommendation. *Evidence synthesis no. 124. AHRQ Publication no. 14-05201-EF-1*. Rockville, MD: Agency for Healthcare Research and Quality.

Noar, S. M., & Zimmerman, R. S. (2005). Health behavior theory and cumulative knowledge regarding health behaviors: Are we moving in the right direction? *Health Education Research, 20(*3), 275-290. https://doi.org/10.1093/her/cyg113

Oberg, E. B., & Frank, E. (2009). Physicians' health practices strongly influence patient health practices. *The Journal of the Royal College of Physicians of Edinburgh, 39*(4), 290-291. https://doi.org/10.4997/jrcpe.2009.422

O'Brien, K. (2007). The lifestyle influence: "Do As I Say, Not As I Do". *American Medical Association Journal of Ethics, 9*(7), 511-513. Retrieved from http://journalofethics.ama-assn.org/2007/07/oped1-0707.html

Office of Disease Prevention and Health Promotion. (2016). Disparities. Retrieved from https://www.healthypeople.gov/2020/about/foundation-health-measures/Disparities

Ogilvie, G. S., Smith, L. W., van Niekerk, D., Khurshed, F., Pedersen, H. N., Taylor, D.,…Coldman, A. J. (2016). Correlates of women's intentions to be screened for human papillomavirus for cervical cancer screening with an extended interval. *BMC Public Health, 16(*213), 1-8. https://doi.org/10.1186/s12889-016-2865-8

O'Keefe, E. B., Meltzer, J. P., & Bethea, T. N. (2015). Health disparities and cancer: Racial disparities in cancer mortality in the United States, 2000-2010. *Frontiers in Public Health, 3(*51), 1-15. https://doi.org/10.3389/fpubh.2015.00051

O'Leary, A. (1985). Self-efficacy and health. *Behavior Research & Therapy, 23(*4), 437-451. http://dx.doi.org/10.1016/0005-7967(85)90172-X

Oliver, R. L., & Berger, P. K. (1979). A path analysis of preventive health care decision models. *Journal of Consumer Research, 6,* 113-122. https://doi.org/10.1086/208755

Perkins, M. B., Jensen, P. S., Jaccard, J., Gollwitzer, P., Oettingen, G., Pappadopulos, E., & Hoagwood, K. E. (2007). Applying theory driven approaches to understanding and modifying clinicians' behavior: What do we know? *Psychiatric Services, 58(*3), 342-348. Retrieved from http://ps.psychiatryonline.org/doi/full/10.1176/ps.2007.58.3.342

Pierannunzi, C., Hu, S. S., & Balluz, L. (2013). A systematic review of publications assessing reliability and validity of the Behavioral Risk Factor Surveillance System (BRFSS), 2004-2011. *BMC Medical Research Methodology, 13(*1), 1-14. https://doi.org/10.1186/1471-2288-13-49

Raffle, A. E., Alden, B., Quinn, M., Babb, P. J., & Brett, M. T. (2003). Outcomes of screening to prevent cancer: analysis of cumulative incidence of cervical abnormality and modelling of cases and deaths prevented. *British Medical Journal, 326(*7395), 901. http://dx.doi.org/10.1136/bmj.326.7395.901

Ransohoff, D. F., & Sox, H. C. (2016). Clinical practice guidelines for colorectal cancer screening: New recommendations and new challenges. *Journal of the American Medical Association, 315(*23), 2529-2531. https://doi.org/10.1001/jama.2016.7990

Rawl, S., Champion, V., Menon, U., Loehrer, P. J., Vance, G. H., & Skinner, C. S. (2001). Validation of scales to measure benefits of and barriers to colorectal cancer screening. *Journal of Psychosocial Oncology, 19(3-4*), 47-63. https://doi.org/10.1300/j077v19n03_05

Reno, D. R. (1988). Men's knowledge and health beliefs about testicular cancer and testicular self-examination. *Cancer Nursing, 11(*2), 112-117. Retrieved from http://journals.lww.com/cancernursingonline/Abstract/1988/04000/Men_s_knowledge_and_health_beliefs_about.6.aspx

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education Quarterly, 15(*2), 175-183. https://doi.org/10.1177/109019818801500203

Sallis, J. F., Pinski, R. B., Grossman, R. M., Patterson, T. L., & Nader, P. R. (1988). The development of self-efficacy scales for health related diet and exercise behaviors. *Health Education Research, 3(*3), 283-292. https://doi.org/10.1093/her/3.3.283

Schaefer, D. R., & Dillman, D. A. (1998). Development of a standard e-mail methodology: Results of an experiment. *The Public Opinion Quarterly, 62(*3), 378-397. Retrieved from http://www.jstor.org/stable/2749665

Schroy, P. C., Barrison, A. F., Ling, B. S., Wilson, S., & Geller, A. C. (2002). Family history and colorectal cancer screening: A survey of physician knowledge and practice patterns. *The American Journal of Gastroenterology, 97,* 1031-1036. https://doi.org/10.1111/j.1572-0241.2002.05624.x

Sharma, V. K., Vasudeva, R., & Howden, C. W. (2000). Colorectal cancer screening and surveillance practices by primary care physicians: Results of a national survey. *The American Journal of Gastroenterology, 95(*6), 1551-1556. https://doi.org/10.1111/j.1572-0241.2000.02093.x

Siegel, R. L., Miller, K. D., & Jemal, A. (2016). Cancer statistics, 2016. *CA: A Cancer Journal for Clinicians*, 66, 7-30. https://doi.org/10.3322/caac.21332

Singh, G. K., Miller, B. A., Hankey, B. F. & Edwards, B. K. (2004). Persistent area socioeconomic disparities in U.S. incidence of cervical cancer, mortality, stage, and survival, 1975–2000. *Cancer*, 101: 1051–1057. https://doi.org/10.1002/cncr.20467

Smith, L., van Diekerk, D., Coldman, A., Krajden, M., Franco, E. L., & Ogilvie, G. (2016). Recommendations for implementing human papillomavirus-based cervical cancer screening: Lessons learned from the HPV FOCAL trial. *Journal of Obstetrics and Gynaecology Canada*, 1-4. http://dx.doi.org/10.1016/j.jogc.2016.04.009

Smith, R. A., Andrews, K., Brooks, D., DeSantis, C. E., Fedewa, S. A., Lortet-Tieulent, J., …Wender, R. C. (2016). Cancer screening in the United States, 2015: A review of current American Cancer Society guidelines and current issues in cancer screening. *CA: A Cancer Journal for Clinicians, 65(*1), 30-54. https://doi.org/10.3322/caac.21261

Stein, J. A., Fox, S. A., Murata, P. J., & Morisky, D. E. (1992). Mammography usage and the Health Belief Model. *Health Education Quarterly, 19(*4), 447-462. https://doi.org/10.1177/109019819201900409

Strecher, V. J., DeVellis, B., Becker, M. H., & Rosenstock, I. M. (1986). The role of self-efficacy in achieving health behavior change. *Health Education Behavior, 13(*1), 73-92. https://doi.org/10.1177/109019818601300108

Street, R. L., & Epstein, R. M. (2008). Key interpersonal functions and health outcomes: Lessons from theory and research on clinician-patient communication. In K. Glanz, B. K. Rimer, & K. Viswanath, (4th ed.), *Health behavior and health education: Theory, research, and practice* (pp. 237-269). San Francisco, CA: Jossey-Bass.

Texas Department of State Health Services. (2014). *2014 Texas Selected Cancer Facts.* [Pamphlet]. Retrieved from http://www.dshs.state.tx.us/tcr/statisticalData/2014FactSheets/ Texas-Fact-Sheets-2014.aspx

Texas Department of State Health Services. (2015, June 9). Texas Behavioral Risk Factor Surveillance System. Retrieved January 14, 2016 from http://www.dshs.state.tx.us/chs/brfss/

Texas Health and Safety Code. (1989). Local public health reorganization act. Chapter 102, Section 102.002(3). Retrieved from http://www.statutes.legis.state.tx.us/Docs/HS/htm/HS.102.htm

U.S. Department of Health and Human Services. (2000). *Healthy People 2020: Disparities.* Washington DC: US Government Printing Office. Retrieved from http://www.healthypeople.gov/2020/about/disparitiesAbout.aspx

U.S. Department of Health, Education, and Welfare. (1979). *Healthy people: The surgeon general's report on health promotion and disease prevention.* Washington DC: US Government Printing Office. Retrieved from https://profiles.nlm.nih.gov/ps/retrieve/ResourceMetadata/NNBBGK/p-segmented/true

U.S. Department of Health and Human Services. (2016). *Healthy People 2020: Cancer.* Washington DC: US Government Printing Office. Retrieved from https://www.healthypeople.gov/node/3513/objectives#4054

U.S. Preventive Services Task Force. (2008). Screening for colorectal cancer: U.S. Preventive Services Task Force recommendation statement. *Annals of Internal Medicine, 149*(9), 627-638. https://doi.org/10.7326/0003-4819-149-9-200811040-00243

U. S. Preventive Services Taskforce. (2016). About the USPSTF. Retrieved from https://www.uspreventiveservicestaskforce.org/Page/Name/about-the-uspstf

U.S. Preventive Services Task Force. (2016, January). *Breast cancer: Screening.* Retrieved from http://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/breast-cancer-screening1?ds=1&s=breast%20cancer%20screening

U.S. Preventive Services Task Force. (2016). *Colorectal cancer: Screening – Draft Recommendation Statement.* Retrieved from http://www.uspreventiveservicestaskforce.org/Page/Document/draft-recommendation-statement38/colorectal-cancer-screening2#tab

Villani, J., & Mortensen, K. (2013). Patient-provider communication and timely receipt of preventive services. *Preventive Medicine, 57,* 658-663. https://doi.org/10.1016/j.ypmed.2013.08.034

Viswanath, K., Breen, N., Meissner, H., Moser, R. P., Hesse, B., Steele, W. R., & Rakowski, W. (2007). Cancer knowledge and disparities in the information age. *Journal of Health Communication, 11,* 1-17. https://doi.org/10.1080/10810730600637426

Wang, W. L., Wang, C. J., & Tseng, H. F. (2009). Comparing knowledge, health beliefs, and self-efficacy toward hepatitis B prevention among university students with different hepatitis B virus infectious statuses. *Journal of Nursing Research, 17(*1), 10-19. https://doi.org/10.1097/jnr.0b013e3181999ca3

Wee, C. C., McCarthy, E. P., & Phillips, R. S. (2005). Factors associated with colon cancer screening: The role of patient factors and physician counseling. *Preventive Medicine, 41(*1), 23-29. https://doi.org/10.1016/j.ypmed.2004.11.004

Wells, K. B., Lewis, C. E., Leake, B., & Ware, J. E. (1984). Do physicians preach what they practice: A study of physicians' health habits and counseling practices. *Journal of the American Medical Association, 252,* 2846-2848. https://doi.org/10.1001/jama.1984.03350200032016

Weinberg, R. S., Hughes, H. H., Critelli, J. W., England, R., & Jackson, A. (1984). Effects of pre-existing and manipulated levels of self-efficacy on weight loss in a self-control program. *Journal of Research in Personality, 18(3*), 352-358. http://dx.doi.org/10.1016/0092-6566(84)90019-9

Weinstein, N. D. (1993). Testing four competing theories of health-protective behavior. *Health Psychology, 12(*4), 324-333. https://doi.org/10.1037/0278-6133.12.4.324

Weinstein, N. D., & Rothman, A. J. (2005). Commentary: Revitalizing research on health behavior theories. *Health Education Research, 20(*3), 294-297. https://doi.org/10.1093/her/cyg125

Werk, R. S., Hill, J. C., & Graber, J. A. (2016). Impact of knowledge, self-efficacy, and perceived importance on steps taken toward cancer prevention among college men and women. *Journal of Cancer Education. https://doi.org/10.1007/s13187-016-0996-3*

Wernli, K. J., Arao, R. F., Hubbard, R. A., Sprague, B. L., Alford-Teaster, J., Haas, J. S.,…Onega, T. (2016). How have breast cancer screening intervals changed since the 2009 USPSTF guideline update? *Cancer Epidemiology Biomarkers Prevention, 25(*3), 558. https://doi.org/10.1158/1055-9965.epi-16-0079

Winawer, S. J., Fischer, S. E., & Levin, B. (2016). Evidence-based, reality-driven colorectal cancer screening guidelines: The critical relationship of adherence to effectiveness. *Journal of the American Medical Association, 315(*19), 2065-2066. https://doi.org/10.1001/jama.2016.3377

Wirth, M. D., Brandt, H. M., Dolinger, H., Hardin, J. W., Sharpe, P. A., & Eberth, J. M. (2014). Examining connections between screening for breast, cervical and prostate cancer and colorectal cancer screening. *Colorectal Cancer, 3(*3), 253-263. https://doi.org/10.2217/crc.14.18

Zon, R. T., Goss, E., Vogel, V. G., Chlebowski, R. T., Jatoi, I., Robson, M. E.,…Kramer, B. S. (2009). American Society of Clinical Oncology policy statement: The role of the oncologist in cancer prevention and risk assessment. *Journal of Clinical Oncology, 27(*6), 986-993. https://doi.org/10.1200/jco.2008.16.3691

Appendix A

Health Information National Trends Survey (HINTS)

Appendix A

HINTS Survey (Knowledge of Cancer Screening Guidelines)

Breast Cancer Screening Knowledge	1. At what age are women supposed to start having mammograms? a. 0-29 b. 30-39 c. 40 d. 41+ e. When a doctor/health provider says to f. Refused (removed) g. Don't know
	2. In general, once women start having mammograms, about how often should they have them? a. More often than once a year b. Every 1 to <2 years c. Every 2 to < 3 years d. Every 3 to < 5 years e. Every 5 to < 10 years f. Only when there is a problem g. Depends on age h. Other (specify) (removed) i. When doctor/health provider recommends j. Refused (removed) k. Don't know
Cervical Cancer Screening Knowledge	1. Do you think HPV can cause abnormal Pap smears? a. Yes b. No c. Refused (removed) d. Don't know
	2. Do you think HPV can cause cervical cancer? a. Yes b. No c. Refused (removed) d. Don't know
	3. Most medical organizations now recommend a Pap smear every three years for healthy adult women. Have you heard about this change in guidelines? a. Yes b. No

	c. Refused (removed) d. Don't know
	4. Do you think women who get the cervical cancer vaccine or HPV shot should continue to get screened for cervical cancer with the Pap test? a. Yes b. No c. Refused (removed) d. Don't know
	5. In your opinion, how successful is the Pap test at detecting cervical cancer in its earliest stages? a. Not at all successful b. A little successful c. Pretty successful d. Very successful e. Don't know
Colorectal Cancer Screening Knowledge	1. People with colon cancer would have pain or other symptoms prior to being diagnosed. a. Agree (Yes) b. Disagree (No) c. Refused (removed) d. Don't know
	2. At what age are people supposed to start doing home stool blood tests? a. 0-29 b. 30-39 c. 40-49 d. 50 e. 50+ f. When a doctor/health provider says to g. Refused (removed) h. Don't know
	3. In general, once people start doing home blood stool tests, about how often should they do them? a. More often than once a year b. Every 1 to < 2 years c. Every 2 to < 3 years d. Every 3 to < 5 years e. Every 5 to < 10 years f. 10 years or more g. Only when there is a problem h. Depends on age

	i. Depends on results of previous tests (removed) j. Other (specify) (removed) k. When a doctor/health provider says to l. Refused (removed) m. Don't know
	4. At what age are people supposed to start having sigmoidoscopy or colonoscopy exams? a. 0-29 b. 30-39 c. 40-49 d. 50 e. 50+ f. When a doctor/health provider says to g. Refused (removed) h. Don't know
	5. In general, once people start having sigmoidoscopy or colonoscopy exams, about how often should they have them? a. More often than once a year b. Every 1 to < 2 years c. Every 2 to < 3 years d. Every 3 to < 5 years e. Every 5 to < 10 years f. 10 years or more g. Only when there is a problem h. Depends on age i. Depends on results of previous tests (removed) j. Other (specify) (removed) k. When a doctor/health provider says to l. Refused (removed) m. Don't know
	6. Getting checked regularly for colon cancer increases the chances of finding cancer when it's easy to treat. a. Strongly agree b. Somewhat agree c. Somewhat disagree d. Strongly disagree e. No opinion f. Refused (removed) g. Don't know

	7. When would you say the risk of colon cancer is the highest, when you're under 40 years old, between 40 and 60 years old, or over 60 years old? a. Under 40 years old b. Between 40 and 60 years old c. Over 60 years old d. Refused (removed) e. Don't know

1. In section, "colorectal cancer screening knowledge", questions 2 and 4 were combined based on similarity in question and accurate response.
2. All responses, "refused", were removed and replaced with "prefer not to answer". Questions in the final survey may be skipped. Skipping a question corresponds to "prefer not to answer".
3. All responses, "other (specify)", were removed to be consistent with removal of all open-ended questions from the final survey.
4. In section, "colorectal cancer screening knowledge", responses to question 1 were modified from "agree" to "yes" and from "disagree" to "no" to be consistent with responses to similar questions in the section, "cervical cancer screening knowledge".
5. In section, "colorectal cancer screening knowledge", responses to questions 3 and 5 were modified to remove the response, "depends on results of previous tests", to be consistent with responses to a similar question in section, "breast cancer screening knowledge".

Appendix B

Modified Champion Health Belief Model (CHBM) Questionnaire

Appendix B

Modified Champion Health Belief Model (CHBM) Questionnaire

Susceptibility	Breast Cancer	1. It is likely that I will get breast cancer. 2. My chances of getting breast cancer in the next few years are great. 3. I feel I will get breast cancer sometime during my life.
	Cervical Cancer	1. It is likely that I will get cervical cancer. 2. My chances of getting cervical cancer in the next few years are great. 3. I feel I will get cervical cancer sometime during my life.
	Colorectal Cancer	1. It is likely that I will get colorectal cancer. 2. My chances of getting colorectal cancer in the next few years are great. 3. I feel I will get colorectal cancer sometime during my life.
Severity (Seriousness)	Breast Cancer	1. The thought of breast cancer scares me 2. When I think about breast cancer I feel nauseous. 3. If I had breast cancer my career would be endangered. 4. When I think about breast cancer my heart beats faster. 5. Breast cancer would endanger my marriage (or a significant relationship). 6. Breast cancer is a hopeless disease. 7. My feelings about myself would change if I got breast cancer. 8. I am afraid to even think about breast cancer. 9. My financial security would be endangered if I got breast cancer.

		10. Problems I would experience from breast cancer would last a long time. 11. If I got breast cancer, it would be more serious than other diseases. 12. If I had breast cancer, my whole life would change.
	Cervical Cancer	1. The thought of cervical cancer scares me. 2. When I think about cervical cancer I feel nauseous. 3. If I had cervical cancer my career would be endangered. 4. When I think about cervical cancer my heart beats faster. 5. Cervical cancer would endanger my marriage (or a significant relationship). 6. Cervical cancer is a hopeless disease. 7. My feelings about myself would change if I got cervical cancer. 8. I am afraid to even think about cervical cancer. 9. My financial security would be endangered if I got cervical cancer. 10. Problems I would experience from cervical cancer would last a long time. 11. If I got cervical cancer, it would be more serious than other diseases. 12. If I had cervical cancer, my whole life would change.
	Colorectal Cancer	1. The thought of colorectal cancer scares me. 2. When I think about colorectal cancer I feel nauseous. 3. If I had colorectal cancer my career would be endangered. 4. When I think about colorectal cancer my heart beats faster. 5. Colorectal cancer would endanger my marriage (or a significant relationship).

		6. Colorectal cancer is a hopeless disease. 7. My feelings about myself would change if I got colorectal cancer. 8. I am afraid to even think about colorectal cancer. 9. My financial security would be endangered if I ever got colorectal cancer. 10. Problems I would experience from colorectal cancer would last a long time. 11. If I got colorectal cancer, it would be more serious than other diseases. 12. If I had colorectal cancer, my whole life would change.
Benefits	Breast Cancer	1. If I get a mammogram and nothing is found, I do not worry as much about breast cancer. 2. Having a mammogram will help me find breast lumps early. 3. If I find a lump through a mammogram, my treatment for breast cancer may not be as bad. 4. Having a mammogram is the best way for me to find a very small lump. 5. Having a mammogram will decrease my chances of dying from breast cancer.
	Cervical Cancer	1. If I get a Pap test and nothing is found, I do not worry as much about cervical cancer. 2. Having a Pap test will help me find cervical cancer early. 3. If I find evidence of cervical cancer through a Pap test, my treatment for cervical cancer may not be as bad. 4. Having a Pap test is the best way for me to detect cervical cancer. 5. Having a Pap test will decrease my chances of dying from cervical cancer.

	Colorectal Cancer	1. If I get a FOBT, sigmoidoscopy, or colonoscopy and nothing is found, I do not worry as much about colorectal cancer. 2. Having a FOBT, sigmoidoscopy, or colonoscopy will help me find colorectal cancer early 3. If I find evidence of colorectal cancer through a FOBT, sigmoidoscopy, or colonoscopy, my treatment for colorectal cancer may not be as bad. 4. Having a FOBT, sigmoidoscopy, or colonoscopy is the best way for me to detect colorectal cancer. 5. Having a FOBT, sigmoidoscopy, or colonoscopy will decrease my chances of dying from colorectal cancer.
Barriers	Breast Cancer	1. I am afraid to have a mammogram because I might find out something is wrong. 2. I am afraid to have a mammogram because I don't understand what will be done. 3. I don't know how to go about getting a mammogram. 4. Having a mammogram is too embarrassing. 5. Having a mammogram takes too much time. 6. Having a mammogram is too painful. 7. People doing mammograms are rude to women. 8. Having a mammogram exposes me to unnecessary radiation. 9. I cannot remember to schedule a mammogram. 10. I have other problems more important than getting a mammogram. 11. I am too old to need a routine mammogram.
	Cervical Cancer	1. I am afraid to have a Pap test because I might find out something is wrong.

		2. I am afraid to have a Pap test because I don't understand what will be done. 3. I don't know how to go about getting a Pap test. 4. Having a Pap test is too embarrassing. 5. Having a Pap test takes too much time. 6. Having a Pap test is too painful. 7. People doing Pap tests are rude to women. 8. Having a Pap test exposes me to unnecessary risk. 9. I cannot remember to schedule a Pap test. 10. I have other problems more important than getting a Pap test. 11. I am too old to need a routine Pap test.
	Colorectal Cancer	1. I am afraid to have a FOBT, sigmoidoscopy, or colonoscopy because I might find out something is wrong. 2. I am afraid to have a FOBT, sigmoidoscopy, or colonoscopy because I don't understand what will be done. 3. I don't know how to go about getting a FOBT, sigmoidoscopy, or colonoscopy. 4. Having a FOBT, sigmoidoscopy, or colonoscopy is too embarrassing. 5. Having a FOBT, sigmoidoscopy, or colonoscopy takes too much time. 6. Having a FOBT, sigmoidoscopy, or colonoscopy is too painful. 7. People doing FOBT, sigmoidoscopy, or colonoscopy exams are rude. 8. Having a FOBT, sigmoidoscopy, or colonoscopy exposes me to unnecessary risk.

		9. I cannot remember to schedule a FOBT, sigmoidoscopy, or colonoscopy. 10. I have other problems more important than getting a FOBT, sigmoidoscopy, or colonoscopy. 11. I am too old to need a routine FOBT, sigmoidoscopy, or colonoscopy.
Self-efficacy (confidence)	Breast Cancer	1. You can arrange transportation to get a mammogram. 2. You can arrange other things in your life to have a mammogram. 3. You can talk to people at the mammogram center about your concerns. 4. You can get a mammogram even if you don't know what to expect. 5. You can find a way to pay for a mammogram. 6. You know for sure you can get a mammogram if you really want to. 7. You know how to go about getting a mammogram. 8. You can find a place to have a mammogram.
	Cervical Cancer	1. You can arrange transportation to get a Pap/HPV test. 2. You can arrange other things in your life to have a Pap/HPV test. 3. You can talk to people at the testing center about your concerns. 4. You can get a Pap/HPV test even if you don't know what to expect. 5. You can find a way to pay for a Pap/HPV test. 6. You know for sure you can get a Pap/HPV test if you really want to. 7. You know how to go about getting a Pap/HPV test.

		8. You can find a place to have a Pap/HPV test performed.
	Colorectal Cancer	1. You can arrange transportation to get a FOBT, sigmoidoscopy, or colonoscopy. 2. You can arrange other things in your life to have a FOBT, sigmoidoscopy, or colonoscopy. 3. You can talk to people at the testing center about your concerns. 4. You can get a FOBT, sigmoidoscopy, or colonoscopy even if you don't know what to expect. 5. You can find a way to pay for a FOBT, sigmoidoscopy, or colonoscopy. 6. You know for sure you can get a FOBT, sigmoidoscopy, or colonoscopy if you really want to. 7. You know how to go about getting a FOBT, sigmoidoscopy, or colonoscopy. 8. You can find a place to have a FOBT, sigmoidoscopy, or colonoscopy performed.

Note. Adapted from Champion Health Belief Model Scales (Champion, 1984; Champion, Skinner, & Menon, 2005).

Appendix C

Behavioral Risk Factor Surveillance Survey (BRFSS)

Appendix C

BRFSS Questions: Breast, Cervical, and Colorectal Cancer Screening

Type of Screening	***BRFSS Question***
Breast Cancer Screening (If male, skip section)	A mammogram is an x-ray of each breast to look for breast cancer. Have you ever had a mammogram? 1 Yes 2 No 7 Don't know/Not sure 9 Refused
	How long has it been since you had your last mammogram? 1 Within the past year (anytime less than 12 months ago) 2 Within the past 2 years (1 year but less than 2 years ago) 3 Within the past 3 years (2 years but less than 3 years ago) 4 Within the past 5 years (3 years but less than 5 years ago) 5 5 or more years ago 7 Don't know/Not sure 9 Refused
Cervical Cancer Screening (If male, skip section)	A Pap test is a test for cancer of the cervix. Have you ever had a Pap test? 1 Yes 2 No 7 Don't know/Not sure 9 Refused
	How long has it been since you had your last Pap test? 1 Within the past year (anytime less than 12 months ago) 2 Within the past 2 years (1 year but less than 2 years ago) 3 Within the past 3 years (2 years but less than 3 years ago) 4 Within the past 5 years (3 years but less than 5 years ago) 5 5 or more years ago 7 Don't know/Not sure 9 Refused
	Now, I would like to ask you about the Human Papillomavirus (Pap-uh-loh-muh virus) or HPV test. An HPV test is sometimes given with the Pap test for cervical cancer screening. Have you ever had an HPV test? 1 Yes 2 No 7 Don't know/Not sure 9 Refused
	How long has it been since you had your last HPV test? 1 Within the past year (anytime less than 12 months ago) 2 Within the past 2 years (1 year but less than 2 years ago) 3 Within the past 3 years (2 years but less than 3 years ago) 4 Within the past 5 years (3 years but less than 5 years ago) 5 5 or more years ago

	7 Don't know/Not sure 9 Refused
	A hysterectomy is an operation to remove the uterus (womb). Have you had a hysterectomy? 1 Yes 2 No 7 Don't know/Not sure 9 Refused
Colorectal Cancer Screening (If </= 49 years of age, skip section)	A blood stool test is a test that may use a special kit at home to determine whether the stool contains blood. Have you ever had this test using a home kit? 1 Yes 2 No 7 Don't know/Not sure 9 Refused
	How long has it been since you had your last blood stool test using a home kit? 1 Within the past year (anytime less than 12 months ago) 2 Within the past 2 years (1 year but less than 2 years ago) 3 Within the past 3 years (2 years but less than 3 years ago) 4 Within the past 5 years (3 years but less than 5 years ago) 5 5 or more years ago
	Sigmoidoscopy and colonoscopy are exams in which a tube is inserted in the rectum to view the colon for signs of cancer or other health problems. Have you ever had either of these exams? 1 Yes 2 No 7 Don't know/Not sure 9 Refused
	For a SIGMOIDOSCOPY, a flexible tube is inserted into the rectum to look for problems. A COLONOSCOPY is similar, but uses a longer tube, and you are usually given medication through a needle in your arm to make you sleepy and told to have someone else drive you home after the test. Was your MOST RECENT exam a sigmoidoscopy or a colonoscopy? 1 Sigmoidoscopy 2 Colonoscopy 7 Don't know/Not sure 9 Refused
	How long has it been since you had your last sigmoidoscopy or colonoscopy? 1 Within the past year (anytime less than 12 months ago) 2 Within the past 2 years (1 year but less than 2 years ago) 3 Within the past 3 years (2 years but less than 3 years ago) 4 Within the past 5 years (3 years but less than 5 years ago) 5 Within the past 10 years (5 years but less than 10 years ago)

	6 10 or more years ago

Note. *Adapted from* Centers for Disease Control and Prevention. (2016). *Behavioral Risk Factor Surveillance System Survey Questionnaire*. Atlanta, GA: U. S. Department of Health and Human Services, Centers for Disease Control and Prevention. Retrieved from https://www.cdc.gov/brfss/

Appendix D

Cancer Screening Knowledge, Perceptions, and Behavior Survey

Cancer Screening Knowledge, Perceptions, and Behavior Survey

Page 1 of 2

Eligibility

What is your age?

- Less than 21 years
- Greater than or equal to 21, but less than 30
- Greater than or equal to 30, but less than 40
- Greater than or equal to 40, but less than 50
- Greater than or equal to 50, but less than 60
- Greater than or equal to 60, but less than 70
- Greater than 70 years
- Prefer not to answer

Which one of these groups best represents your oncology health care profession/role?

- Physician
- Physician trainee
- Dentist
- Advanced practice provider
- Nurse
- Nursing or Medical assistant
- Pharmacist
- Physical or Occupational therapist
- Respiratory therapist
- Speech pathologist
- Case manager
- Social worker
- Dietician/Nutrition support
- Chaplain
- Technician
- Other
- I am not an oncology health care professional
- Prefer not to answer

How many years have you worked at MD Anderson Cancer Center?

- 0-2 years
- 3-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 21-30 years
- Greater than 30 years
- I do not work at MD Anderson Cancer Center
- Prefer not to answer

Are you...?

- Male
- Female

- Prefer not to answer

Have you ever been diagnosed with or treated for cervical cancer?

- No
- Yes
- Prefer not to answer

Have you ever been diagnosed with or treated for breast cancer?

- No
- Yes
- Prefer not to answer

Have you ever been diagnosed with or treated for colorectal cancer?

- No
- Yes
- Prefer not to answer

Demographics

Your answers to the questions below will help to determine whether you are eligible to participate further in this study and appropriately identify which questions pertain to you.

Which one of these groups would you say best represents your race/ethnicity?

- White
- Black or African-American
- Hispanic, Latino/a, or Spanish origin
- Asian
- American-Indian or Alaska Native
- Other
- Prefer not to answer

Do you have an immediate family member (i.e., 1st degree relative) who has ever been diagnosed with cervical, breast, or colorectal cancer?

- No
- Yes
- Prefer not to answer

Please select the cancer diagnosis of your immediate family member(s) (may check more than one)

- cervical
- breast
- colorectal

Knowledge about Cancer Screening Guidelines

A mammogram is an x-ray of each breast to look for breast cancer. At what age are women supposed to start having mammograms?

- 0-29
- 30-39
- 40
- 41+
- When a doctor/health provider says to
- Don't know

- Prefer not to answer

In general, once women start having mammograms, about how often should they have them?

- More often than once a year
- Every 1 to < 2 years
- Every 2 to < 3 years
- Every 4 to < 5 years
- Every 5 to < 10 years
- Only when there is a problem
- Depends on age
- When a doctor/health provider recommends
- Don't know
- Prefer not to answer

A Pap test is a test for cancer of the cervix. Do you think the Human Papillomavirus (HPV) can cause abnormal Pap tests?

- No
- Yes
- Don't know
- Prefer not to answer

Do you think HPV can cause cervical cancer?

- No
- Yes
- Don't know
- Prefer not to answer

Most medical organizations now recommend a Pap test every 3 years for healthy adult women.

Have you heard about this change in guidelines?

- No
- Yes
- Don't know
- Prefer not to answer

Do you think women who get the cervical cancer vaccine or HPV shot should continue to get screened for cervical cancer with the Pap test?

- No
- Yes
- Don't know
- Prefer not to answer

In your opinion, how successful is the Pap test in detecting cervical cancer in its earliest stages?

- Not at all successful
- A little successful
- Pretty successful
- Very successful
- Don't know
- Prefer not to answer

In general, people with colon cancer would have pain or other symptoms prior to being diagnosed.

- No
- Yes
- Don't know
- Maybe
- Prefer not to answer

A blood stool test is a test that may use a special kit at home to determine whether the stool contains blood. Sigmoidoscopy and colonoscopy are exams in which a tube is inserted in the rectum to view the colon for signs of cancer or other health problems.

At what age are people supposed to start doing blood stool tests/sigmoidoscopy/colonoscopies?

- 0-29
- 30-39
- 40-49
- 50
- 50+
- When a doctor/health provider says to
- Don't know
- Prefer not to answer

In general, once people start doing blood stool tests, about how often should they do them?

- More often than once a year
- Every 1 to < 2 years
- Every 2 to < 3 years
- Every 3 to < 5 years
- Every 5 to < 10 years
- 10 years or more
- Only when there is a problem
- Depends on age
- When a doctor/health provider says to
- Don't know
- Prefer not to answer

In general, once people start having a sigmoidoscopy exam, about how often should they have them?

- More often than once a year
- Every 1 to < 2 years
- Every 2 to < 3 years
- Every 3 to < 5 years
- Every 5 to < 10 years
- 10 years or more
- Only when there is a problem
- Depends on age
- When a doctor/health provider says to
- Don't know
- Prefer not to answer

In general, once people start having a colonoscopy exam, about how often should they have them?

- More often than once a year
- Every 1 to < 2 years
- Every 2 to < 3 years
- Every 3 to < 5 years
- Every 5 to < 10 years
- 10 years or more
- Only when there is a problem
- Depends on age
- When a doctor/health provider says to
- Don't know
- Prefer not to answer

Getting checked regularly for colon cancer increases the chances of finding cancer when it's easy to treat.

- Strongly agree
- Somewhat agree
- Somewhat disagree
- Strongly disagree
- Don't know
- Prefer not to answer

When would you say the risk of colon cancer is the highest, when you're under 40 years old, between 40 and 60 years old, or over 60 years old?

- Under 40 years old
- Between 40 and 60 years old
- Over 60 years old
- Don't know
- Prefer not to answer

This concludes the section on Knowledge of Cancer Screening Guidelines.

Cervical cancer screening beliefs

Please select the response that best reflects your beliefs about cervical cancer screening using the 5-point scale (1= strongly disagree, 5= strongly agree)

1. It is likely that I will get cervical cancer.
2. My chances of getting cervical cancer in the next few years are great.
3. I feel I will get cervical cancer sometime during my life.

Cervical cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about cervical cancer screening using the 5-point scale (1= strongly disagree, 5= strongly agree)

1. The thought of cervical cancer scares me.
2. When I think about cervical cancer I feel nauseous.

3. If I had cervical cancer my career would be endangered.
4. When I think about cervical cancer my heart beats faster.
5. Cervical cancer would endanger my marriage (or a significant relationship)
6. Cervical cancer is a hopeless disease.
7. My feelings about myself would change if I got cervical cancer.
8. I am afraid to even think about cervical cancer.
9. My financial security would be endangered if I got cervical cancer.
10. Problems I would experience from cervical cancer would last a long time.
11. If I got cervical cancer, it would be more serious than other diseases.
12. If I had cervical cancer, my whole life would change.

Cervical cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about cervical cancer screening using the 5-point scale (1= strongly disagree, 5= strongly agree)

1. If I get a Pap test and nothing is found, I do not worry as much about cervical cancer.
2. Having a Pap test will help me find cervical cancer early.
3. If I find evidence of cervical cancer through a Pap test, my treatment for cervical cancer may not be as bad.
4. Having a Pap test is the best way for me to detect cervical cancer.
5. Having a Pap test will decrease my chances of dying from cervical cancer.

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Cervical cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about cervical cancer screening using the 5-point scale (1= strongly disagree, 5= strongly agree)

1. I am afraid to have a Pap test because I might find out something is wrong.
2. I am afraid to have a Pap test because I don't understand what will be done.
3. I don't know how to go about getting a Pap test.
4. Having a Pap test is too embarrassing.
5. Having a Pap test takes too much time.
6. Having a Pap test is too painful.
7. People doing Pap tests are rude to women.
8. Having a Pap test exposes me to unnecessary risk.
9. I cannot remember to schedule a Pap test.
10. I have other problems more important than getting a Pap test.
11. I am too old to need a routine Pap test.

Cervical cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about cervical cancer screening using the 5-point scale (1= strongly disagree, 5= strongly agree)

1. You can arrange transportation to get a Pap/HPV test.
2. You can arrange other things in your life to have a Pap/HPV test.
3. You can talk to people at the testing center about your concerns.
4. You can get a Pap/HPV test even if you don't know what to expect.
5. You can find a way to pay for a Pap/HPV test.
6. You know for sure you can get a Pap/HPV test if you really want to.
7. You know how to go about getting a Pap/HPV test.
8. You can find a place to have a Pap/HPV test performed.

Cervical cancer screening behaviors

1. A Pap test is a test for cancer of the cervix. Have you ever had a Pap test?
   - Yes
   - No
   - Don't know/Not sure
   - Prefer not to answer

1a. How long has it been since you had your last Pap test?
   - Within the past year (anytime less than 12 months ago)
   - Within the past two years (1 year but less than 2 years ago)
   - Within the past three years (2 years but less than 3 years ago)
   - Within the past five years (3 years but less than 5 years ago)
   - Five or more years ago
   - Don't know/Not sure
   - Prefer not to answer

2. Now I would like to ask you about the Human Papillomavirus or HPV test. An HPV test is sometimes done with the Pap test for cervical cancer screening. Have you ever had an HPV test?
   - Yes
   - No
   - Don't know/Not sure
   - Prefer not to answer

2a. How long has it been since you had your last HPV test?
   - Within the past year (anytime less than 12 months ago)
   - Within the past two years (1 year but less than 2 years ago)
   - Within the past three years (2 years but less than 3 years ago)
   - Within the past five years (3 years but less than 5 years ago)
   - Five or more years ago
   - Don't know/Not sure
   - Prefer not to answer

3. A hysterectomy is an operation to remove the uterus (womb). Have you had a hysterectomy?
   - Yes
   - No
   - Don't know/Not sure
   - Prefer not to answer

Breast cancer screening beliefs

Breast cancer screening beliefs

Please select the response that best reflects your beliefs about breast cancer screening using the 5-point scale (1= strongly disagree, 5= strongly agree)

1. It is likely that I will get breast cancer.
2. My chances of getting breast cancer in the next few years are great.
3. I feel I will get breast cancer sometime during my life.

Breast cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about breast cancer screening using the 5-point scale (1= strongly disagree, 5= strongly agree)

1. The thought of breast cancer scares me.
2. When I think about breast cancer I feel nauseous.
3. If I had breast cancer my career would be endangered.
4. When I think about breast cancer my heart beats faster.
5. Breast cancer would endanger my marriage (or a significant relationship).
6. Breast cancer is a hopeless disease.
7. My feelings about myself would change if I got breast cancer.
8. I am afraid to even think about breast cancer.
9. My financial security would be endangered if I got breast cancer.
10. Problems I would experience from breast cancer would last a long time.
11. If I got breast cancer, it would be more serious than other diseases.
12. If I had breast cancer, my whole life would change.

Breast cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about breast cancer screening using the 5-point scale (1= strongly disagree, 5= strongly agree)

1. If I get a mammogram and nothing is found, I do not worry as much about breast cancer.
2. Having a mammogram will help me find breast lumps early.
3. If I find a lump through a mammogram, my treatment for breast cancer may not be as bad.
4. Having a mammogram is the best way for me to find a very small lump.
5. Having a mammogram will decrease my chances of dying from breast cancer.

Breast cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about breast cancer screening using the 5-point scale (1= strongly disagree, 5= strongly agree)

1. I am afraid to have a mammogram because I might find out something is wrong.
2. I am afraid to have a mammogram because I don't understand what will be done.
3. I don't know how to go about getting a mammogram.
4. Having a mammogram is too embarrassing.
5. Having a mammogram takes too much time.
6. Having a mammogram is too painful.
7. People doing mammograms are rude to women.
8. Having a mammogram exposes me to unnecessary radiation.
9. I cannot remember to schedule a mammogram.
10. I have other problems more important than getting a mammogram.
11. I am too old to need a routine mammogram.

Breast cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about breast cancer screening using the 5-point scale (1= strongly disagree, 5= strongly agree)

1. You can arrange transportation to get a mammogram.
2. You can arrange other things in your life to have a mammogram.
3. You can talk to people at the mammogram center about your concerns.
4. You can get a mammogram even if you don't know what to expect.
5. You can find a way to pay for a mammogram.
6. You know for sure you can get a mammogram if you really want to.
7. You know how to go about getting a mammogram.
8. You can find a place to have a mammogram.

Breast cancer screening behaviors

1. A mammogram is an x-ray of each breast to look for breast cancer. Have you ever had a mammogram?
   - Yes
   - No
   - Don't know/Not sure
   - Prefer not to answer

1a. How long has it been since you had your last mammogram?
   - Within the past year (anytime less than 12 months ago)
   - Within the past two years (1 year but less than 2 years ago)
   - Within the past three years (2 years but less than 3 years ago)
   - Within the past five years (3 years but less than 5 years ago)
   - Five or more years ago
   - Don't know/Not sure
   - Prefer not to answer

Colorectal cancer screening beliefs

Colorectal cancer screening beliefs

Please select the response that best reflects your beliefs about colorectal cancer using the
5-point scale (1= strongly disagree, 5= strongly agree)

1. It is likely that I will get colorectal cancer.
2. My chances of getting colorectal cancer in the next few years are great.
3. I feel I will get colorectal cancer sometime during my life.

Colorectal cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about colorectal cancer using the
5-point scale (1= strongly disagree, 5= strongly agree)

1. The thought of colorectal cancer scares me.
2. When I think about colorectal cancer I feel nauseous.
3. If I had colorectal cancer my career would be endangered.
4. When I think about colorectal cancer my heart beats faster.
5. Colorectal cancer would endanger my marriage (or a significant relationship).
6. Colorectal cancer is a hopeless disease.
7. My feelings about myself would change if I got colorectal cancer.
8. I am afraid to even think about colorectal cancer.
9. My financial security would be endangered if I got colorectal cancer.
10. Problems I would experience from colorectal cancer would last a long time.
11. If I got colorectal cancer, it would be more serious than other diseases.
12. If I had colorectal cancer, my whole life would change.

Colorectal cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about colorectal cancer using the
5-point scale (1= strongly disagree, 5= strongly agree)

1. If I get a blood stool test, sigmoidoscopy, or colonoscopy and nothing is found, I do not worry as much about colorectal cancer.
2. Having a blood stool test, sigmoidoscopy, or colonoscopy will help me find colorectal cancer early.
3. If I find evidence of colorectal cancer through a blood stool test, sigmoidoscopy, or colonoscopy, my treatment for colorectal cancer may not be as bad.
4. Having a blood stool test, sigmoidoscopy, or colonoscopy is the best way for me to detect colorectal cancer.
5. Having a blood stool test, sigmoidoscopy, or colonoscopy will decrease my chances of dying from colorectal cancer.

Colorectal cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about colorectal cancer using the
5-point scale (1= strongly disagree, 5= strongly agree)

1. I am afraid to have a blood stool test, sigmoidoscopy, or colonoscopy because I might find out something is wrong.
2. I am afraid to have a blood stool test, sigmoidoscopy, or colonoscopy because I don't understand what will be done.
3. I don't know how to go about getting a blood stool test, sigmoidoscopy, or colonoscopy.
4. Having a blood stool test, sigmoidoscopy, or colonoscopy is too embarrassing.
5. Having a blood stool test, sigmoidoscopy, or colonoscopy takes too much time.
6. Having a blood stool test, sigmoidoscopy, or colonoscopy is too painful.
7. People doing a blood stool test, sigmoidoscopy, or colonoscopy are rude.
8. Having a blood stool test, sigmoidoscopy, or colonoscopy exposes me to unnecessary risk.
9. I cannot remember to schedule a blood stool test, sigmoidoscopy, or colonoscopy.
10. I have other problems more important than getting a blood stool test, sigmoidoscopy, or colonoscopy.
11. I am too old to need a blood stool test, sigmoidoscopy, or colonoscopy.

Colorectal cancer screening beliefs (continued)

Please select the response that best reflects your beliefs about colorectal cancer using the
5-point scale (1= strongly disagree, 5= strongly agree)

1. You can arrange transportation to get a blood stool test, sigmoidoscopy, or colonoscopy.
2. You can arrange other things in your life to have a blood stool test, sigmoidoscopy, or colonoscopy.
3. You can talk to people at the testing center about your concerns.
4. You can get a blood stool test, sigmoidoscopy, or colonoscopy even if you don't know what to expect.
5. You can find a way to pay for a blood stool test, sigmoidoscopy, or colonoscopy.
6. You know for sure you can get a blood stool test, sigmoidoscopy, or colonoscopy if you really want to.
7. You know how to go about getting a blood stool test, sigmoidoscopy, or colonoscopy.
8. You can find a place to have a blood stool test, sigmoidoscopy, or colonoscopy performed.

Colorectal cancer screening behaviors

1. A blood stool test is a test that may use a special kit at home to determine whether the stool contains blood. Have you ever had this test using a home kit?
- Yes
- No
- Don't know/Not sure
- Prefer not to answer

1a. How long has it been since you had your last blood stool test using a home kit?
- Within the past year (anytime less than 12 months ago)
- Within the past two years (1 year but less than 2 years ago)
- Within the past three years (2 years but less than 3 years ago)
- Within the past five years (3 years but less than 5 years ago)
- 5 or more years ago
- Don't know/Not sure
- Prefer not to answer

2. Sigmoidoscopy and colonoscopy are exams in which a tube is inserted in the rectum to view the colon for signs of cancer or other health problems. Have you ever had either of these exams?
- Yes
- No
- Don't know/Not sure
- Prefer not to answer

2a. For a sigmoidoscopy, a flexible tube is inserted into the rectum to look for problems. A colonoscopy is similar, but uses a longer tube, and you are usually given medication through a needle in your arm to make you sleepy and told to have someone else drive you home after the test. Was your most recent exam a sigmoidoscopy or a colonoscopy?
- Sigmoidoscopy
- Colonoscopy
- Don't know/Not sure
- Prefer not to answer

2b. How long has it been since you had your last sigmoidoscopy or colonoscopy?

- Within the past year (anytime less than 12 months ago)
- Within the past two years (1 year but less than 2 years ago)
- Within the past three years (2 years but less than 3 years ago)
- Within the past five years (3 years but less than 5 years ago)
- Within the past ten years (5 years but less than 10 years ago)
- 10 or more years ago
- Don't know/Not sure
- Prefer not to answer

Survey Completion

Thank you for the time spent taking this survey. Your response is very valuable and will be used to improve the health and well-being of our employees by focusing on the development of a comprehensive cancer screening program.

Your survey response is anonymous. If you have any questions, contact Kimberly Tripp, Principle Investigator, ktripp@emailaddress.

Appendix E

Initial Solicitation E-mail

Initial Solicitation E-mail

Dear colleague,

I'd like to ask for your participation in a survey of fellow oncology health care professionals at our institution that will help assess our knowledge about cancer screening guidelines, beliefs about preventive cancer screening and personal adherence to preventive cancer screening exams. The goal of this research study is to learn how often oncology health care professionals adhere to the cancer screening guidelines for breast, cervical and colorectal cancers.

You must be 21 years of age or older to participate in the survey, qualify as an oncology health care professional and be employed at the study institution in order to participate. The length of the survey is dependent upon your response to demographic questions determining your eligibility to respond to cancer preventive screening questions for cervical, breast and colorectal cancers. On average, the survey should take no more than 30 minutes to complete.

This survey is anonymous and your participation is voluntary. If you come to any question you prefer not to answer, please select "prefer not to answer" and go to the next question.

Take the survey.

This survey has been approved by the Institutional Review Board (IRB) of the study institution and is also part of a University of Houston dissertation study approved by its IRB.

If you have any questions or comments, please contact Kimberly Tripp, the principal investigator, at (xxx) xxx-xxxx or ktripp@emailaddress.org.

Appendix F

First Reminder E-mail (1st Survey Period)

1st Reminder E-mail

First Survey Period

Dear colleague,

Last week I sent an e-mail to ask for your participation in a survey of fellow oncology health care professionals at our institution to help assess our knowledge about cancer screening guidelines, beliefs about preventive cancer screening and personal adherence to preventive cancer screening exams. The goal of this research study is to learn how often oncology health care professionals adhere to the cancer screening guidelines for breast, cervical and colorectal cancers.

Since the survey is anonymous, personally identifiable responses are not recorded. Therefore, if you have already responded to this survey, thank you. If you have not responded, I hope that providing you with this gentle reminder and a link to the survey will make it easy for you to respond. Remember, if you come to any question you prefer not to answer, please select "prefer not to answer" and go to the next question.

You must be 21 years of age or older to participate in the survey, qualify as an oncology health care professional and be employed at the study institution in order to participate. The length of the survey is dependent upon your response to demographic questions determining your eligibility to respond to cancer preventive screening questions for cervical, breast and colorectal cancers. On average, the survey should take no more than 30 minutes to complete.

Take the survey.

This survey has been approved by the Institutional Review Board (IRB) of the study institution and is also part of a University of Houston dissertation study approved by its IRB.

If you have any questions or comments, please contact Kimberly Tripp, the principal investigator, at (xxx) xxx-xxxx or ktripp@emailaddress.org.

I recognize that your response is voluntary and I appreciate your considering my request.

Appendix G

Second Reminder E-mail (1st Survey Period)

2nd Reminder E-mail

First Survey Period

Dear colleague,

This is the **final week** of the Cancer Screening Knowledge, Perceptions, and Behavior Survey. The purpose of this survey is to help assess our knowledge about cancer screening guidelines, beliefs about preventive cancer screening, and personal adherence to preventive cancer screening exams. The goal of this research study is to learn how often oncology health care professionals adhere to the cancer screening guidelines for breast, cervical and colorectal cancers.

The survey will close this Thursday, March 22nd, at 10:00 am. If you have already responded to this survey, thank you. If you have not responded, I hope that providing you with this gentle reminder and a link to the survey will make it easy for you to respond. Remember, if you come to any question you prefer not to answer, please select "prefer not to answer" and go to the next question.

Take the survey.

This survey has been approved by the Institutional Review Board (IRB) of the study institution and is also part of a University of Houston dissertation study approved by its IRB.

If you have any questions or comments, please contact Kimberly Tripp, the principal investigator, at (xxx) xxx-xxxx or ktripp@emailaddress.org.

I recognize that your response is voluntary and I appreciate your considering my request.

Appendix H

Reminder E-mail (2nd Survey Period)

Reminder E-mail

Second Survey Period

Dear colleague,

Due to the spring break week that occurred during the survey period, the **Cancer Screening Knowledge, Perceptions, and Behavior Survey has been re-opened**. The purpose of this survey is to help assess our knowledge about cancer screening guidelines, beliefs about preventive cancer screening, and personal adherence to preventive cancer screening exams. The goal of this research study is to learn how often oncology health care professionals adhere to the cancer screening guidelines for breast, cervical and colorectal cancers.

If you have already responded to this survey, thank you. **Your feedback may be used to help inform the development of comprehensive cancer screening programs** for employees at the study institution. If you have not responded, I hope that extending the survey period will make it easy for you to respond. Remember, if you come to any question you prefer not to answer, please select "prefer not to answer" and go to the next question.

Take the survey.

This survey has been approved by the Institutional Review Board (IRB) of the study institution and is also part of a University of Houston dissertation study approved by its IRB.

If you have any questions or comments, please contact Kimberly Tripp, the principal investigator, at (xxx) xxx-xxxx or ktripp@emailaddress.org.

I recognize that your response is voluntary and I appreciate your considering my request.

Appendix I

Knowledge of Cancer Screening Guidelines Answer Key

Characteristic: Knowledge of Cancer Screening Guidelines	N	%
A mammogram is an x-ray of each breast to look for breast cancer.		
At what age are women supposed to start having mammograms?		
0-29	11	2.36
30-39	56	12.02
40	318	68.24
41+	62	13.30
When a doctor/health provider says to	10	2.15
Don't know	8	1.72
Prefer not to answer	1	0.21
In general, once women start having mammograms, about how often should they have them?		
More often than once a year	3	0.64
Every 1 to < 2 years	342	73.39
Every 2 to < 3 years	46	9.87
Every 4 to < 5 years	24	5.15
Every 5 to < 10 years	14	3.00
Depends on age	20	4.29
When a doctor/health provider recommends	9	1.93
Don't know	8	1.72
A Pap test is a test for cancer of the cervix. Do you think the Human Papillomavirus can cause abnormal tests?		
No	19	4.08
Yes	424	90.99
Don't know	21	4.51
Prefer not to answer	2	0.43
Do you think HPV can cause cervical cancer?		
No	4	0.86
Yes	452	97.00
Don't know	10	2.15
Most medical organizations now recommend a Pap test every 3 years for healthy adult women. Have you heard about this change in guidelines?		
No	149	32.25
Yes	305	66.02
Don't know	7	1.52
Prefer not to answer	1	0.22
Do you think women who get the cervical cancer vaccine or HPV shot should continue to get screened for cervical cancer with the Pap test?		

No	16	3.46
Yes	433	93.72
Don't know	13	2.81
In your opinion, how successful is the Pap test in detecting cervical cancer in detecting cervical cancer in its earliest stages?		
Not at all successful	2	0.43
A little successful	17	3.67
Pretty successful	169	36.50
Very successful	204	44.06
Don't know	69	14.90
Prefer not to answer	2	0.43
In general, people with colon cancer would have pain or other symptoms prior to being diagnosed.		
No	232	50.33
Yes	100	21.69
Don't know	24	5.21
Maybe	103	22.34
Prefer not to answer	2	0.43
A blood stool test is a test that may use a special kit at home to determine whether the stool contains blood. Sigmoidoscopy and colonoscopy are exams in which a tube is inserted in the rectum to view the colon for signs of cancer or other health problems. At what age are people supposed to start doing blood stool tests/sigmoidoscopy/colonoscopies?		
0-29	1	0.22
30-39	15	3.24
40-49	39	8.42
50	328	70.84
50+	51	11.02
When a doctor/health provider says to	14	3.02
Don't know	15	3.24
In general, once people start doing blood stool tests, about how often should they do them?		
More often than once a year	6	1.30
Every 1 to < 2 years	179	38.83
Every 2 to < 3 years	33	7.16
Every 3 to < 5 years	62	13.45
Every 5 to < 10 years	48	10.41
10 years or more	8	1.74
Only when there is a problem	19	4.12
Depends on age	9	1.95
When a doctor/health provider says to	33	7.16
Don't know	61	13.23
Prefer not to answer	3	0.65

In general, once people start having a sigmoidoscopy exam, about how often should they have them?		
Every 1 to < 2 years	42	9.15
Every 2 to < 3 years	28	6.10
Every 3 to < 5 years	106	23.09
Every 5 to < 10 years	135	29.41
10 years or more	16	3.49
Only when there is a problem	17	3.70
Depends on age	13	2.83
When a doctor/health provider says to	30	6.54
Don't know	71	15.47
Prefer not to answer	1	0.22
In general, once people start having a colonoscopy exam, about how often should they have them?		
More often than once a year	1	0.22
Every 1 to < 2 years	54	11.74
Every 2 to < 3 years	23	5.00
Every 3 to < 5 years	76	16.52
Every 5 to < 10 years	185	40.22
10 years or more	64	13.91
Only when there is a problem	2	0.43
Depends on age	8	1.74
When a doctor/health provider says to	22	4.78
Don't know	23	5.00
Prefer not to answer	2	0.43
Getting checked regularly for colon cancer increases the chances of finding cancer when it's easy to treat.		
Strongly agree	384	83.66
Somewhat agree	55	11.98
Somewhat disagree	4	0.87
Strongly disagree	9	1.96
Don't know	5	1.09
Prefer not to answer	2	0.44
When would you say the risk of colon cancer is the highest, when you're under 40 years old, between 40 and 60 years old, or over 60 years old?		
Under 40 years old	6	1.30
Between 40 and 60 years old	266	57.83
Over 60 years old	175	38.04
Don't know	11	2.39
Prefer not to answer	2	0.43

Appendix J

Summary of Statistics of Knowledge

Characteristic	N	%
Knowledge Score		
N	467	
Mean (SD)	66.35	(15.21)
Median (Min-Max)	71.43	7.14 - 100.00
# Knowledge answers correct		
1	1	0.21
2	3	0.64
3	1	0.21
4	8	1.71
5	13	2.78
6	23	4.93
7	36	7.71
8	58	12.42
9	76	16.27
10	113	24.20
11	78	16.70
12	37	7.92
13	19	4.07
14	1	0.21
A mammogram is an x-ray of each breast to look for breast cancer. At what age are women supposed to start having mammograms?		
Incorrect	149	31.91
Correct	318	68.09
In general, once women start having mammograms, about how often should they have them?		
Incorrect	125	26.77
Correct	342	73.23
A Pap test is a test for cancer of the cervix. Do you think the Human Papillomavirus (HPV) can cause abnormal Pap tests?		
Incorrect	43	9.21
Correct	424	90.79
Do you think HPV can cause cervical cancer?		
Incorrect	15	3.21
Correct	452	96.79
Most medical organizations now recommend a Pap test every 3 years for healthy adult women. Have you heard about this change in guidelines?		
Incorrect	162	34.69

Correct	305	65.31
Do you think women who get the cervical cancer vaccine or HPV shot should continue to get screened for cervical cancer with the Pap test?		
Incorrect	34	7.28
Correct	433	92.72
In your opinion, how successful is the Pap test in detecting cervical cancer in its earliest stages?		
Incorrect	94	20.13
Correct	373	79.87
In general, people with colon cancer would have pain or other symptoms prior to being diagnosed.		
Incorrect	132	28.27
Correct	335	71.73
A blood stool test is a test that may use a special kit at home to determine whether the stool contains blood. Sigmoidoscopy and colonoscopy are exams in which a tube is inserted in the rectum to view the colon for signs of cancer or other health problems. At what age are people supposed to start doing blood stool tests/sigmoidoscopy/colonoscopies?		
Incorrect	139	29.76
Correct	328	70.24
In general, once people start doing blood stool tests, about how often should they do them?		
Incorrect	288	61.67
Correct	179	38.33
In general, once people start having a sigmoidoscopy exam, about how often should they have them?		
Incorrect	332	71.09
Correct	135	28.91
In general, once people start having a colonoscopy exam, about how often should they have them?		
Incorrect	403	86.30
Correct	64	13.70
Getting checked regularly for colon cancer increases the chances of finding cancer when it’s easy to treat.		
Incorrect	83	17.77
Correct	384	82.23
When would you say the risk of colon cancer is the highest, when you’re under 40 years old, between 40 and 60 years old, or over 60 years old?		
Incorrect	201	43.04

Correct	266	56.96

Appendix K

Summary of Cervical Cancer Screening Beliefs

Characteristic	N	%
It is likely that I will get cervical cancer.		
1 Strongly disagree	132	36.36
2 Disagree	141	38.84
3 Neither agree nor disagree	70	19.28
4 Agree	11	3.03
5 Strongly agree	4	1.10
Prefer not to answer	5	1.38
My chances of getting cervical cancer in the next few years are great.		
1 Strongly disagree	144	39.56
2 Disagree	147	40.38
3 Neither agree nor disagree	57	15.66
4 Agree	8	2.20
5 Strongly agree	5	1.37
Prefer not to answer	3	0.82
I feel I will get cervical cancer sometime during my life.		
1 Strongly disagree	150	41.21
2 Disagree	140	38.46
3 Neither agree nor disagree	56	15.38
4 Agree	13	3.57
5 Strongly agree	2	0.55
Prefer not to answer	3	0.82
The thought of cervical cancer scares me.		
1 Strongly disagree	40	11.30
2 Disagree	43	12.15
3 Neither agree nor disagree	47	13.28
4 Agree	126	35.59
5 Strongly agree	95	26.84
Prefer not to answer	3	0.85
When I think about cervical cancer I feel nauseous.		
1 Strongly disagree	99	28.13
2 Disagree	124	35.23
3 Neither agree nor disagree	75	21.31
4 Agree	28	7.95
5 Strongly agree	21	5.97
Prefer not to answer	5	1.42
If I had cervical cancer my career would be endangered.		
1 Strongly disagree	75	21.25
2 Disagree	110	31.16
3 Neither agree nor disagree	59	16.71
4 Agree	75	21.25
5 Strongly agree	31	8.78
Prefer not to answer	3	0.85

When I think about cervical cancer my heart beats faster.		
1 Strongly disagree	95	27.07
2 Disagree	123	35.04
3 Neither agree nor disagree	64	18.23
4 Agree	49	13.96
5 Strongly agree	16	4.56
Prefer not to answer	4	1.14
Cervical cancer would endanger my marriage (or a significant relationship)		
1 Strongly disagree	124	35.13
2 Disagree	107	30.31
3 Neither agree nor disagree	63	17.85
4 Agree	40	11.33
5 Strongly agree	13	3.68
Prefer not to answer	6	1.70
Cervical cancer is a hopeless disease.		
1 Strongly disagree	116	32.77
2 Disagree	168	47.46
3 Neither agree nor disagree	47	13.28
4 Agree	12	3.39
5 Strongly agree	7	1.98
Prefer not to answer	4	1.13
My feelings about myself would change if I got cervical cancer.		
1 Strongly disagree	77	21.81
2 Disagree	95	26.91
3 Neither agree nor disagree	79	22.38
4 Agree	77	21.81
5 Strongly agree	20	5.67
Prefer not to answer	5	1.42
I am afraid to even think about cervical cancer.		
1 Strongly disagree	103	29.18
2 Disagree	141	39.94
3 Neither agree nor disagree	51	14.45
4 Agree	41	11.61
5 Strongly agree	12	3.40
Prefer not to answer	5	1.42
My financial security would be endangered if I got cervical cancer.		
1 Strongly disagree	56	16.00
2 Disagree	75	21.43
3 Neither agree nor disagree	66	18.86
4 Agree	105	30.00
5 Strongly agree	43	12.29
Prefer not to answer	5	1.43
Problems I would experience from cervical cancer would last a long time.		
1 Strongly disagree	35	10.00

2 Disagree	55	15.71
3 Neither agree nor disagree	93	26.57
4 Agree	120	34.29
5 Strongly agree	43	12.29
Prefer not to answer	4	1.14
If I got cervical cancer, it would be more serious than other diseases.		
1 Strongly disagree	55	15.76
2 Disagree	94	26.93
3 Neither agree nor disagree	106	30.37
4 Agree	69	19.77
5 Strongly agree	20	5.73
Prefer not to answer	5	1.43
If I had cervical cancer, my whole life would change.		
1 Strongly disagree	33	9.51
2 Disagree	62	17.87
3 Neither agree nor disagree	75	21.61
4 Agree	126	36.31
5 Strongly agree	47	13.54
Prefer not to answer	4	1.15
If I get a Pap test and nothing is found, I do not worry as much about cervical		
1 Strongly disagree	5	1.44
2 Disagree	19	5.48
3 Neither agree nor disagree	29	8.36
4 Agree	191	55.04
5 Strongly agree	101	29.11
Prefer not to answer	2	0.58
Having a Pap test will help me find cervical cancer early.		
1 Strongly disagree	1	0.29
2 Disagree	2	0.58
3 Neither agree nor disagree	14	4.06
4 Agree	198	57.39
5 Strongly agree	127	36.81
Prefer not to answer	3	0.87
If I find evidence of cervical cancer through a Pap test, my treatment for cervical cancer may not be as bad.		
1 Strongly disagree	6	1.73
2 Disagree	39	11.24
3 Neither agree nor disagree	89	25.65
4 Agree	143	41.21
5 Strongly agree	66	19.02
Prefer not to answer	4	1.15
Having a Pap test is the best way for me to detect cervical cancer.		
1 Strongly disagree	2	0.58
2 Disagree	7	2.03
3 Neither agree nor disagree	25	7.25

4 Agree	191	55.36
5 Strongly agree	118	34.20
Prefer not to answer	2	0.58
Having a Pap test will decrease my chances of dying from cervical cancer.		
1 Strongly disagree	3	0.86
2 Disagree	14	4.03
3 Neither agree nor disagree	60	17.29
4 Agree	159	45.82
5 Strongly agree	107	30.84
Prefer not to answer	4	1.15
I am afraid to have a Pap test because I might find out something is wrong.		
1 Strongly disagree	224	65.69
2 Disagree	96	28.15
3 Neither agree nor disagree	8	2.35
4 Agree	10	2.93
Prefer not to answer	3	0.88
I am afraid to have a Pap test because I don't understand what will be done.		
1 Strongly disagree	239	69.88
2 Disagree	91	26.61
3 Neither agree nor disagree	6	1.75
4 Agree	3	0.88
Prefer not to answer	3	0.88
I don't know how to go about getting a Pap test.		
1 Strongly disagree	259	75.73
2 Disagree	76	22.22
3 Neither agree nor disagree	3	0.88
4 Agree	1	0.29
Prefer not to answer	3	0.88
Having a Pap test is too embarrassing.		
1 Strongly disagree	233	68.53
2 Disagree	80	23.53
3 Neither agree nor disagree	14	4.12
4 Agree	8	2.35
5 Strongly agree	2	0.59
Prefer not to answer	3	0.88
Having a Pap test takes too much time.		
1 Strongly disagree	226	66.28
2 Disagree	94	27.57
3 Neither agree nor disagree	12	3.52
4 Agree	5	1.47
5 Strongly agree	1	0.29
Prefer not to answer	3	0.88
Having a Pap test is too painful.		
1 Strongly disagree	208	60.64
2 Disagree	102	29.74

3 Neither agree nor disagree	16	4.66
4 Agree	12	3.50
5 Strongly agree	2	0.58
Prefer not to answer	3	0.87
People doing Pap tests are rude to women.		
1 Strongly disagree	241	70.47
2 Disagree	91	26.61
3 Neither agree nor disagree	5	1.46
4 Agree	1	0.29
Prefer not to answer	4	1.17
Having a Pap test exposes me to unnecessary risk.		
1 Strongly disagree	235	68.71
2 Disagree	96	28.07
3 Neither agree nor disagree	7	2.05
4 Agree	1	0.29
Prefer not to answer	3	0.88
I cannot remember to schedule a Pap test.		
1 Strongly disagree	198	58.24
2 Disagree	102	30.00
3 Neither agree nor disagree	14	4.12
4 Agree	18	5.29
5 Strongly agree	4	1.18
Prefer not to answer	4	1.18
I have other problems more important than getting a Pap test.		
1 Strongly disagree	198	58.06
2 Disagree	110	32.26
3 Neither agree nor disagree	23	6.74
4 Agree	6	1.76
5 Strongly agree	1	0.29
Prefer not to answer	3	0.88
I am too old to need a routine Pap test.		
1 Strongly disagree	206	60.23
2 Disagree	111	32.46
3 Neither agree nor disagree	9	2.63
4 Agree	9	2.63
5 Strongly agree	4	1.17
Prefer not to answer	3	0.88
You can arrange transportation to get a Pap/HPV test.		
1 Strongly disagree	6	1.76
2 Disagree	8	2.35
3 Neither agree nor disagree	38	11.14
4 Agree	127	37.24
5 Strongly Agree	158	46.33
Prefer not to answer	4	1.17
You can arrange other things in your life to have a Pap/HPV test.		
1 Strongly disagree	4	1.18

2 Disagree	7	2.06
3 Neither agree nor disagree	14	4.12
4 Agree	147	43.24
5 Strongly Agree	164	48.24
Prefer not to answer	4	1.18
You can talk to people at the testing center about your concerns.		
1 Strongly disagree	2	0.59
2 Disagree	4	1.18
3 Neither agree nor disagree	14	4.14
4 Agree	151	44.67
5 Strongly Agree	163	48.22
Prefer not to answer	4	1.18
You can get a Pap/HPV test even if you don't know what to expect.		
1 Strongly disagree	3	0.88
2 Disagree	2	0.59
3 Neither agree nor disagree	9	2.65
4 Agree	152	44.71
5 Strongly Agree	170	50.00
Prefer not to answer	4	1.18
You can find a way to pay for a Pap/HPV test.		
1 Strongly disagree	2	0.59
2 Disagree	4	1.18
3 Neither agree nor disagree	15	4.44
4 Agree	141	41.72
5 Strongly Agree	172	50.89
Prefer not to answer	4	1.18
You know for sure you can get a Pap/HPV test if you really want to.		
1 Strongly disagree	2	0.59
2 Disagree	3	0.88
3 Neither agree nor disagree	9	2.64
4 Agree	135	39.59
5 Strongly Agree	188	55.13
Prefer not to answer	4	1.17
You know how to go about getting a Pap/HPV test.		
1 Strongly disagree	2	0.59
2 Disagree	3	0.89
3 Neither agree nor disagree	5	1.48
4 Agree	128	37.87
5 Strongly Agree	196	57.99
Prefer not to answer	4	1.18
You can find a place to have a Pap/HPV test performed.		
1 Strongly disagree	2	0.59
2 Disagree	4	1.18
3 Neither agree nor disagree	4	1.18
4 Agree	128	37.65

5 Strongly Agree	198	58.24
Prefer not to answer	4	1.18

Appendix L

Statistical Summary of Breast Cancer Screening Beliefs

Characteristic	N	%
It is likely that I will get breast cancer.		
1 Strongly disagree	25	13.37
2 Disagree	70	37.43
3 Neither agree nor disagree	66	35.29
4 Agree	20	10.70
5 Strongly agree	3	1.60
Prefer not to answer	3	1.60
My chances of getting breast cancer in the next few years are great.		
1 Strongly disagree	30	16.04
2 Disagree	75	40.11
3 Neither agree nor disagree	64	34.22
4 Agree	13	6.95
5 Strongly agree	2	1.07
Prefer not to answer	3	1.60
I feel I will get breast cancer sometime during my life.		
1 Strongly disagree	31	16.58
2 Disagree	65	34.76
3 Neither agree nor disagree	62	33.16
4 Agree	23	12.30
5 Strongly agree	2	1.07
Prefer not to answer	4	2.14
The thought of breast cancer scares me.		
1 Strongly disagree	15	8.11
2 Disagree	31	16.76
3 Neither agree nor disagree	28	15.14
4 Agree	85	45.95
5 Strongly agree	25	13.51
Prefer not to answer	1	0.54
When I think about breast cancer I feel nauseous.		
1 Strongly disagree	50	27.17
2 Disagree	73	39.67
3 Neither agree nor disagree	31	16.85
4 Agree	20	10.87
5 Strongly agree	8	4.35
Prefer not to answer	2	1.09
If I had breast cancer my career would be endangered.		
1 Strongly disagree	32	17.68
2 Disagree	64	35.36
3 Neither agree nor disagree	30	16.57
4 Agree	38	20.99
5 Strongly agree	15	8.29
Prefer not to answer	2	1.10
When I think about breast cancer my heart beats faster.		
1 Strongly disagree	47	25.82

2 Disagree	59	32.42
3 Neither agree nor disagree	27	14.84
4 Agree	38	20.88
5 Strongly agree	9	4.95
Prefer not to answer	2	1.10
Breast cancer would endanger my marriage (or a significant relationship).		
1 Strongly disagree	65	35.14
2 Disagree	73	39.46
3 Neither agree nor disagree	26	14.05
4 Agree	12	6.49
5 Strongly agree	5	2.70
Prefer not to answer	4	2.16
Breast cancer is a hopeless disease.		
1 Strongly disagree	65	35.14
2 Disagree	90	48.65
3 Neither agree nor disagree	18	9.73
4 Agree	9	4.86
5 Strongly agree	2	1.08
Prefer not to answer	1	0.54
My feelings about myself would change if I got breast cancer.		
1 Strongly disagree	36	19.46
2 Disagree	59	31.89
3 Neither agree nor disagree	35	18.92
4 Agree	43	23.24
5 Strongly agree	11	5.95
Prefer not to answer	1	0.54
I am afraid to even think about breast cancer.		
1 Strongly disagree	49	26.49
2 Disagree	76	41.08
3 Neither agree nor disagree	30	16.22
4 Agree	21	11.35
5 Strongly agree	8	4.32
Prefer not to answer	1	0.54
My financial security would be endangered if I got breast cancer.		
1 Strongly disagree	27	14.67
2 Disagree	43	23.37
3 Neither agree nor disagree	38	20.65
4 Agree	50	27.17
5 Strongly agree	24	13.04
Prefer not to answer	2	1.09
Problems I would experience from breast cancer would last a long time.		
1 Strongly disagree	19	10.33
2 Disagree	30	16.30
3 Neither agree nor disagree	46	25.00

4 Agree	63	34.24
5 Strongly agree	24	13.04
Prefer not to answer	2	1.09
If I got breast cancer, it would be more serious than other diseases.		
1 Strongly disagree	26	14.21
2 Disagree	59	32.24
3 Neither agree nor disagree	54	29.51
4 Agree	32	17.49
5 Strongly agree	10	5.46
Prefer not to answer	2	1.09
If I had breast cancer, my whole life would change.		
1 Strongly disagree	21	11.48
2 Disagree	32	17.49
3 Neither agree nor disagree	32	17.49
4 Agree	74	40.44
5 Strongly agree	22	12.02
Prefer not to answer	2	1.09
If I get a mammogram and nothing is found, I do not worry as much about breast cancer		
1 Strongly disagree	3	1.64
2 Disagree	19	10.38
3 Neither agree nor disagree	20	10.93
4 Agree	100	54.64
5 Strongly agree	40	21.86
Prefer not to answer	1	0.55
Having a mammogram will help me find breast lumps early.		
2 Disagree	13	7.07
3 Neither agree nor disagree	10	5.43
4 Agree	110	59.78
5 Strongly agree	50	27.17
Prefer not to answer	1	0.54
If I find a lump through a mammogram, my treatment for breast cancer may not be as bad		
1 Strongly disagree	2	1.09
2 Disagree	21	11.41
3 Neither agree nor disagree	42	22.83
4 Agree	86	46.74
5 Strongly agree	31	16.85
Prefer not to answer	2	1.09
Having a mammogram is the best way for me to find a very small lump.		
1 Strongly disagree	2	1.09
2 Disagree	24	13.04
3 Neither agree nor disagree	23	12.50
4 Agree	97	52.72
5 Strongly agree	37	20.11
Prefer not to answer	1	0.54

Having a mammogram will decrease my chances of dying from breast cancer.		
1 Strongly disagree	1	0.55
2 Disagree	12	6.59
3 Neither agree nor disagree	33	18.13
4 Agree	90	49.45
5 Strongly agree	44	24.18
Prefer not to answer	2	1.10
I am afraid to have a mammogram because I might find out something is wrong.		
1 Strongly disagree	100	55.25
2 Disagree	67	37.02
3 Neither agree nor disagree	6	3.31
4 Agree	7	3.87
Prefer not to answer	1	0.55
I am afraid to have a mammogram because I don't understand what will be done.		
1 Strongly disagree	116	64.09
2 Disagree	59	32.60
3 Neither agree nor disagree	1	0.55
4 Agree	4	2.21
Prefer not to answer	1	0.55
I don't know how to go about getting a mammogram.		
1 Strongly disagree	117	63.93
2 Disagree	61	33.33
3 Neither agree nor disagree	1	0.55
4 Agree	1	0.55
5 Strongly agree	2	1.09
Prefer not to answer	1	0.55
Having a mammogram is too embarrassing.		
1 Strongly disagree	114	62.30
2 Disagree	61	33.33
3 Neither agree nor disagree	4	2.19
4 Agree	2	1.09
5 Strongly agree	1	0.55
Prefer not to answer	1	0.55
Having a mammogram takes too much time.		
1 Strongly disagree	104	57.46
2 Disagree	64	35.36
3 Neither agree nor disagree	3	1.66
4 Agree	8	4.42
5 Strongly agree	1	0.55
Prefer not to answer	1	0.55
Having a mammogram is too painful.		
1 Strongly disagree	82	44.81
2 Disagree	68	37.16
3 Neither agree nor disagree	9	4.92
4 Agree	20	10.93

5 Strongly agree	2	1.09
Prefer not to answer	2	1.09
People doing mammograms are rude to women.		
1 Strongly disagree	114	62.64
2 Disagree	63	34.62
3 Neither agree nor disagree	3	1.65
5 Strongly agree	1	0.55
Prefer not to answer	1	0.55
Having a mammogram exposes me to unnecessary radiation.		
1 Strongly disagree	90	49.18
2 Disagree	72	39.34
3 Neither agree nor disagree	13	7.10
4 Agree	6	3.28
5 Strongly agree	1	0.55
Prefer not to answer	1	0.55
I cannot remember to schedule a mammogram.		
1 Strongly disagree	98	53.55
2 Disagree	67	36.61
3 Neither agree nor disagree	4	2.19
4 Agree	11	6.01
5 Strongly agree	2	1.09
Prefer not to answer	1	0.55
I have other problems more important than getting a mammogram.		
1 Strongly disagree	92	50.83
2 Disagree	73	40.33
3 Neither agree nor disagree	12	6.63
4 Agree	3	1.66
Prefer not to answer	1	0.55
I am too old to need a routine mammogram.		
1 Strongly disagree	108	59.34
2 Disagree	70	38.46
3 Neither agree nor disagree	2	1.10
5 Strongly agree	1	0.55
Prefer not to answer	1	0.55
You can arrange transportation to get a mammogram.		
1 Strongly disagree	2	1.11
3 Neither agree nor disagree	8	4.44
4 Agree	84	46.67
5 Strongly agree	85	47.22
Prefer not to answer	1	0.56
You can arrange other things in your life to have a mammogram.		
2 Disagree	1	0.56
3 Neither agree nor disagree	5	2.78
4 Agree	86	47.78
5 Strongly agree	87	48.33

Prefer not to answer	1	0.56
You can talk to people at the mammogram center about your concerns.		
1 Strongly disagree	2	1.11
2 Disagree	1	0.56
3 Neither agree nor disagree	4	2.22
4 Agree	82	45.56
5 Strongly agree	90	50.00
Prefer not to answer	1	0.56
You can get a mammogram even if you don't know what to expect.		
2 Disagree	2	1.10
3 Neither agree nor disagree	2	1.10
4 Agree	85	46.96
5 Strongly agree	91	50.28
Prefer not to answer	1	0.55
You can find a way to pay for a mammogram.		
2 Disagree	2	1.10
3 Neither agree nor disagree	3	1.66
4 Agree	81	44.75
5 Strongly agree	94	51.93
Prefer not to answer	1	0.55
You know for sure you can get a mammogram if you really want to.		
2 Disagree	1	0.56
4 Agree	76	42.46
5 Strongly agree	101	56.42
Prefer not to answer	1	0.56
You know how to go about getting a mammogram.		
2 Disagree	3	1.66
3 Neither agree nor disagree	1	0.55
4 Agree	73	40.33
5 Strongly agree	102	56.35
Prefer not to answer	2	1.10
You can find a place to have a mammogram.		
2 Disagree	1	0.56
4 Agree	72	40.45
5 Strongly agree	103	57.87
Prefer not to answer	2	1.12

Appendix M

Statistical Summary of Colorectal Cancer Screening Beliefs

Characteristic	N	%
It is likely that I will get colorectal cancer.		
1 Strongly disagree	20	16.13
2 Disagree	46	37.10
3 Neither agree nor disagree	47	37.90
4 Agree	9	7.26
5 Strongly agree	2	1.61
My chances of getting colorectal cancer in the next few years are great.		
1 Strongly disagree	17	13.71
2 Disagree	46	37.10
3 Neither agree nor disagree	50	40.32
4 Agree	10	8.06
5 Strongly agree	1	0.81
I feel I will get colorectal cancer sometime during my life.		
1 Strongly disagree	22	17.89
2 Disagree	47	38.21
3 Neither agree nor disagree	47	38.21
4 Agree	5	4.07
5 Strongly agree	2	1.63
The thought of colorectal cancer scares me.		
1 Strongly disagree	13	10.66
2 Disagree	18	14.75
3 Neither agree nor disagree	29	23.77
4 Agree	47	38.52
5 Strongly agree	15	12.30
When I think about colorectal cancer I feel nauseous.		
1 Strongly disagree	37	30.58
2 Disagree	52	42.98
3 Neither agree nor disagree	21	17.36
4 Agree	7	5.79
5 Strongly agree	4	3.31
If I had colorectal cancer my career would be endangered.		
1 Strongly disagree	23	19.17
2 Disagree	38	31.67
3 Neither agree nor disagree	19	15.83
4 Agree	29	24.17
5 Strongly agree	11	9.17
When I think about colorectal cancer my heart beats faster.		
1 Strongly disagree	36	30.00
2 Disagree	49	40.83
3 Neither agree nor disagree	22	18.33
4 Agree	9	7.50
5 Strongly agree	4	3.33
Colorectal cancer would endanger my marriage (or a significant relationship).		

1 Strongly disagree	44	36.67
2 Disagree	45	37.50
3 Neither agree nor disagree	17	14.17
4 Agree	9	7.50
5 Strongly agree	4	3.33
Prefer not to answer	1	0.83
Colorectal cancer is a hopeless disease.		
1 Strongly disagree	46	38.33
2 Disagree	49	40.83
3 Neither agree nor disagree	17	14.17
4 Agree	4	3.33
5 Strongly agree	4	3.33
My feelings about myself would change if I got colorectal cancer.		
1 Strongly disagree	27	22.50
2 Disagree	35	29.17
3 Neither agree nor disagree	24	20.00
4 Agree	27	22.50
5 Strongly agree	7	5.83
I am afraid to even think about colorectal cancer.		
1 Strongly disagree	34	28.33
2 Disagree	50	41.67
3 Neither agree nor disagree	24	20.00
4 Agree	10	8.33
5 Strongly agree	2	1.67
My financial security would be endangered if I got colorectal cancer.		
1 Strongly disagree	23	19.17
2 Disagree	30	25.00
3 Neither agree nor disagree	21	17.50
4 Agree	31	25.83
5 Strongly agree	13	10.83
Prefer not to answer	2	1.67
Problems I would experience from colorectal cancer would last a long time.		
1 Strongly disagree	13	10.83
2 Disagree	24	20.00
3 Neither agree nor disagree	30	25.00
4 Agree	39	32.50
5 Strongly agree	13	10.83
Prefer not to answer	1	0.83
If I got colorectal cancer, it would be more serious than other diseases.		
1 Strongly disagree	19	15.83
2 Disagree	34	28.33
3 Neither agree nor disagree	33	27.50
4 Agree	26	21.67
5 Strongly agree	8	6.67
If I had colorectal cancer, my whole life would change.		

1 Strongly disagree	13	11.02
2 Disagree	23	19.49
3 Neither agree nor disagree	21	17.80
4 Agree	49	41.53
5 Strongly agree	12	10.17
If I get a blood stool test, sigmoidoscopy, or colonoscopy and nothing is found, I do not worry as much about colorectal cancer		
1 Strongly disagree	2	1.68
2 Disagree	6	5.04
3 Neither agree nor disagree	15	12.61
4 Agree	59	49.58
5 Strongly agree	37	31.09
Having a blood stool test, sigmoidoscopy, or colonoscopy will help me find colorectal cancer early		
1 Strongly disagree	1	0.84
3 Neither agree nor disagree	4	3.36
4 Agree	64	53.78
5 Strongly agree	50	42.02
If I find evidence of colorectal cancer through a blood stool test, sigmoidoscopy, or colonoscopy, my treatment for colorectal cancer may not be as bad		
1 Strongly disagree	1	0.84
2 Disagree	10	8.40
3 Neither agree nor disagree	25	21.01
4 Agree	58	48.74
5 Strongly agree	25	21.01
Having a blood stool test, sigmoidoscopy, or colonoscopy is the best way for me to detect colorectal cancer		
3 Neither agree nor disagree	5	4.20
4 Agree	67	56.30
5 Strongly agree	47	39.50
Having a blood stool test, sigmoidoscopy, or colonoscopy will decrease my chances of dying from colorectal cancer		
2 Disagree	5	4.20
3 Neither agree nor disagree	22	18.49
4 Agree	57	47.90
5 Strongly agree	35	29.41
I am afraid to have a blood stool test, sigmoidoscopy, or colonoscopy because I might find out something is wrong		
1 Strongly disagree	57	47.90
2 Disagree	51	42.86
3 Neither agree nor disagree	6	5.04
4 Agree	5	4.20
I am afraid to have a blood stool test, sigmoidoscopy, or colonoscopy because I don’t understand what will be done		
1 Strongly disagree	62	52.10
2 Disagree	52	43.70
3 Neither agree nor disagree	4	3.36

4 Agree	1	0.84
I don’t know how to go about getting a blood stool test, sigmoidoscopy, or colonoscopy		
1 Strongly disagree	59	49.58
2 Disagree	56	47.06
3 Neither agree nor disagree	3	2.52
5 Strongly agree	1	0.84
Having a blood stool test, sigmoidoscopy, or colonoscopy is too embarrassing.		
1 Strongly disagree	57	48.31
2 Disagree	49	41.53
3 Neither agree nor disagree	6	5.08
4 Agree	5	4.24
5 Strongly agree	1	0.85
Having a blood stool test, sigmoidoscopy, or colonoscopy takes too much time.		
1 Strongly disagree	49	41.18
2 Disagree	54	45.38
3 Neither agree nor disagree	6	5.04
4 Agree	6	5.04
5 Strongly agree	4	3.36
Having a blood stool test, sigmoidoscopy, or colonoscopy is too painful.		
1 Strongly disagree	57	47.90
2 Disagree	49	41.18
3 Neither agree nor disagree	9	7.56
4 Agree	3	2.52
5 Strongly agree	1	0.84
People doing a blood stool test, sigmoidoscopy, or colonoscopy are rude.		
1 Strongly disagree	63	52.94
2 Disagree	50	42.02
3 Neither agree nor disagree	6	5.04
Having a blood stool test, sigmoidoscopy, or colonoscopy exposes me to unnecessary		
1 Strongly disagree	57	48.31
2 Disagree	53	44.92
3 Neither agree nor disagree	7	5.93
4 Agree	1	0.85
I cannot remember to schedule a blood stool test, sigmoidoscopy, or colonoscopy.		
1 Strongly disagree	54	45.38
2 Disagree	48	40.34
3 Neither agree nor disagree	5	4.20
4 Agree	10	8.40
5 Strongly agree	2	1.68
I have other problems more important than getting a blood stool test, sigmoidoscopy, or colonoscopy		

1 Strongly disagree	48	41.03
2 Disagree	58	49.57
3 Neither agree nor disagree	10	8.55
4 Agree	1	0.85
I am too old to need a blood stool test, sigmoidoscopy, or colonoscopy.		
1 Strongly disagree	58	48.74
2 Disagree	56	47.06
3 Neither agree nor disagree	5	4.20
You can arrange transportation to get a blood stool test, sigmoidoscopy, or colonoscopy		
1 Strongly disagree	2	1.69
3 Neither agree nor disagree	5	4.24
4 Agree	56	47.46
5 Strongly agree	55	46.61
You can arrange other things in your life to have a blood stool test, sigmoidoscopy, or colonoscopy		
1 Strongly disagree	2	1.68
3 Neither agree nor disagree	4	3.36
4 Agree	56	47.06
5 Strongly agree	57	47.90
You can talk to people at the testing center about your concerns.		
1 Strongly disagree	2	1.68
2 Disagree	2	1.68
3 Neither agree nor disagree	4	3.36
4 Agree	54	45.38
5 Strongly agree	57	47.90
You can get a blood stool test, sigmoidoscopy, or colonoscopy even if you don’t know what to expect		
1 Strongly disagree	2	1.69
2 Disagree	1	0.85
3 Neither agree nor disagree	2	1.69
4 Agree	58	49.15
5 Strongly agree	55	46.61
You can find a way to pay for a blood stool test, sigmoidoscopy, or colonoscopy.		
1 Strongly disagree	1	0.85
3 Neither agree nor disagree	6	5.08
4 Agree	54	45.76
5 Strongly agree	57	48.31
You know for sure you can get a blood stool test, sigmoidoscopy, or colonoscopy		
1 Strongly disagree	1	0.84
3 Neither agree nor disagree	1	0.84
4 Agree	54	45.38
5 Strongly agree	63	52.94
You know how to go about getting a blood stool test, sigmoidoscopy, or colonoscopy		

1 Strongly disagree	1	0.85
2 Disagree	2	1.71
4 Agree	52	44.44
5 Strongly agree	62	52.99
You can find a place to have a blood stool test, sigmoidoscopy, or colonoscopy performed		
1 Strongly disagree	1	0.84
3 Neither agree nor disagree	1	0.84
4 Agree	53	44.54
5 Strongly agree	64	53.78

Appendix N

Logistic Regression Models Assessing Knowledge and CHBM Constructs on Adherence

Association and logistic regression models assessing knowledge and CHBM constructs on adherence

Pap test

	Non Adherent		Adherent						
Effect	**N**	**%**	**N**	**%**	**p-value***	**OR**	**LB**	**UB**	**p-value**
Knowledge Score	62.4 (14.3)	35.7 - 85.7	69.8 (13.1)	28.6 - 92.9	**0.016**	1.04	1.01	1.07	**0.013**
CHBM Cervical Susceptibility	1.7 (0.7)	1.0 - 3.0	2.0 (0.8)	1.0 - 4.0	0.061	1.75	0.94	3.28	0.079
CHBM Cervical Severity	2.6 (0.9)	1.2 - 5.0	2.8 (0.8)	1.0 - 5.0	0.267	1.28	0.73	2.26	0.390
CHBM Cervical Benefits	3.9 (0.5)	3.0 - 5.0	4.0 (0.6)	1.6 - 5.0	0.310	1.50	0.70	3.21	0.293
CHBM Cervical Barriers	1.8 (0.6)	1.0 - 3.4	1.4 (0.5)	1.0 - 3.3	**0.001**	0.25	0.11	0.56	**0.001**
CHBM Cervical Self-efficacy	4.3 (0.6)	3.0 - 5.0	4.5 (0.6)	1.0 - 5.0	0.032	1.80	0.95	3.42	0.072
CHBM breast Susceptibility	2.3 (1.1)	1.0 - 4.7	2.4 (0.8)	1.0 - 4.7	0.382	1.25	0.69	2.25	0.464
CHBM breast Severity	2.8 (0.9)	1.0 - 5.0	2.7 (0.8)	1.0 - 4.8	0.907	0.90	0.49	1.65	0.734
CHBM breast Benefits	4.0 (0.7)	3.0 - 5.0	3.8 (0.6)	2.0 - 5.0	0.452	0.57	0.25	1.30	0.178
CHBM breast Barriers	1.9 (0.7)	1.0 - 3.2	1.5 (0.5)	1.0 - 3.1	**0.037**	0.31	0.12	0.76	**0.011**
CHBM breast Self-efficacy	4.3 (0.6)	3.0 - 5.0	4.5 (0.5)	2.3 - 5.0	0.090	2.12	0.90	4.99	0.085
CHBM colon Susceptibility	2.3 (0.9)	1.0 - 3.0	2.3 (0.9)	1.0 - 5.0	0.962	1.06	0.45	2.50	0.898
CHBM colon Severity	3.1 (0.9)	2.0 - 5.0	2.4 (0.8)	1.0 - 5.0	**0.021**	0.38	0.15	0.98	**0.045**
CHBM colon Benefits	4.2 (0.7)	3.0 - 5.0	4.2 (0.5)	3.2 - 5.0	0.888	1.08	0.25	4.60	0.918
CHBM colon Barriers	1.8 (0.7)	1.0 - 2.8	1.6 (0.5)	1.0 - 2.5	0.435	0.43	0.10	1.86	0.257
CHBM colon Self-efficacy	4.6 (0.5)	4.0 - 5.0	4.5 (0.5)	3.5 - 5.0	0.419	0.63	0.13	2.95	0.553

*rank-sum test

HPV

	Non Adherent		Adherent						
Effect	**N**	**%**	**N**	**%**	**p-value***	**OR**	**LB**	**UB**	**p-value**
Knowledge Score	68.2 (14.7)	35.7 - 92.9	70.3 (12.7)	28.6 - 92.9	0.431	1.01	0.98	1.04	0.404
CHBM Cervical Susceptibility	1.7 (0.6)	1.0 - 3.3	2.0 (0.8)	1.0 - 4.0	**0.013**	1.97	1.13	3.42	**0.016**
CHBM Cervical Severity	2.8 (0.9)	1.3 - 5.0	2.7 (0.7)	1.0 - 4.8	0.985	0.91	0.56	1.50	0.718
CHBM Cervical Benefits	4.0 (0.5)	3.0 - 5.0	4.0 (0.6)	1.6 - 5.0	0.970	0.97	0.49	1.91	0.923
CHBM Cervical Barriers	1.3 (0.5)	1.0 - 2.5	1.4 (0.4)	1.0 - 2.4	0.905	1.11	0.46	2.65	0.820
CHBM Cervical Self-efficacy	4.4 (0.6)	3.0 - 5.0	4.5 (0.5)	2.0 - 5.0	0.196	1.46	0.75	2.83	0.261
CHBM breast Susceptibility	2.2 (1.0)	1.0 - 4.7	2.4 (0.9)	1.0 - 4.7	0.313	1.31	0.75	2.28	0.345
CHBM breast Severity	2.6 (1.0)	1.0 - 5.0	2.8 (0.8)	1.0 - 4.8	0.444	1.27	0.71	2.28	0.427
CHBM breast Benefits	4.1 (0.7)	3.2 - 5.0	3.8 (0.5)	2.4 - 5.0	0.214	0.42	0.17	1.03	0.058
CHBM breast Barriers	1.4 (0.6)	1.0 - 2.8	1.5 (0.5)	1.0 - 2.5	0.349	1.57	0.58	4.27	0.378
CHBM breast Self-efficacy	4.5 (0.6)	3.0 - 5.0	4.5 (0.6)	2.3 - 5.0	0.844	1.07	0.45	2.51	0.879
CHBM colon Susceptibility	2.4 (0.7)	1.0 - 3.0	2.1 (0.8)	1.0 - 4.0	0.400	0.67	0.24	1.88	0.446
CHBM colon Severity	2.7 (1.1)	1.3 - 5.0	2.4 (0.8)	1.0 - 5.0	0.349	0.73	0.31	1.72	0.468
CHBM colon Benefits	4.5 (0.5)	3.8 - 5.0	4.2 (0.5)	3.4 - 5.0	0.132	0.27	0.05	1.38	0.115
CHBM colon Barriers	1.5 (0.7)	1.0 - 2.8	1.6 (0.5)	1.0 - 2.5	0.462	1.35	0.30	6.14	0.701
CHBM colon Self-efficacy	4.8 (0.5)	4.0 - 5.0	4.5 (0.5)	3.5 - 5.0	0.236	0.39	0.07	2.28	0.298

*rank-sum test

Mammogram

	Non Adherent		Adherent						
Effect	**N**	**%**	**N**	**%**	**p-value***	**OR**	**LB**	**UB**	**p-value**
Knowledge Score	62.0 (13.0)	28.6 - 85.7	71.2 (12.8)	7.1 - 100.0	**0.001**	1.05	1.02	1.08	**0.003**
CHBM Cervical Susceptibility	1.7 (0.7)	1.0 - 3.0	1.8 (0.8)	1.0 - 4.3	0.630	1.16	0.66	2.05	0.605
CHBM Cervical Severity	2.5 (1.2)	1.0 - 5.0	2.5 (0.8)	1.0 - 5.0	0.712	1.08	0.65	1.79	0.755
CHBM Cervical Benefits	3.8 (0.7)	2.6 - 5.0	4.0 (0.6)	2.8 - 5.0	0.204	1.70	0.82	3.52	0.155
CHBM Cervical Barriers	1.6 (0.6)	1.0 - 3.3	1.5 (0.5)	1.0 - 3.2	0.247	0.67	0.31	1.43	0.300
CHBM Cervical Self-efficacy	4.3 (0.5)	3.5 - 5.0	4.4 (0.6)	2.0 - 5.0	0.123	1.45	0.72	2.92	0.297
CHBM breast Susceptibility	2.2 (0.9)	1.0 - 3.7	2.5 (0.8)	1.0 - 4.7	0.213	1.50	0.89	2.53	0.125
CHBM breast Severity	2.5 (1.0)	1.0 - 5.0	2.6 (0.8)	1.0 - 4.8	0.441	1.14	0.68	1.90	0.615
CHBM breast Benefits	3.9 (0.7)	2.8 - 5.0	3.8 (0.6)	2.0 - 5.0	0.945	0.82	0.42	1.63	0.576
CHBM breast Barriers	1.7 (0.6)	1.0 - 3.1	1.5 (0.5)	1.0 - 3.0	**0.031**	0.40	0.18	0.89	**0.025**
CHBM breast Self-efficacy	4.4 (0.5)	3.6 - 5.0	4.5 (0.5)	2.3 - 5.0	0.080	1.66	0.76	3.63	0.200
CHBM colon Susceptibility	2.2 (1.0)	1.0 - 4.0	2.3 (0.8)	1.0 - 5.0	0.750	1.13	0.53	2.38	0.752
CHBM colon Severity	2.7 (1.1)	1.2 - 5.0	2.5 (0.8)	1.0 - 5.0	0.486	0.73	0.35	1.52	0.397
CHBM colon Benefits	4.0 (0.7)	3.0 - 5.0	4.1 (0.5)	3.0 - 5.0	0.531	1.68	0.53	5.32	0.375
CHBM colon Barriers	1.6 (0.4)	1.0 - 2.2	1.6 (0.5)	1.0 - 2.6	0.848	0.91	0.26	3.19	0.879
CHBM colon Self-efficacy	4.5 (0.5)	3.8 - 5.0	4.5 (0.5)	3.0 - 5.0	0.779	1.11	0.33	3.69	0.865

*rank-sum test

Colonoscopy

	Non Adherent		Adherent						
Effect	**N**	**%**	**N**	**%**	**p-value***	**OR**	**LB**	**UB**	**p-value**
Knowledge Score	64.3 (19.3)	35.7 - 78.6	69.4 (12.8)	21.4 - 100.0	0.779	1.03	0.96	1.10	0.440
CHBM Cervical Susceptibility	1.5 (0.7)	1.0 - 2.0	1.6 (0.8)	1.0 - 4.3	0.986	1.18	0.18	7.77	0.866
CHBM Cervical Severity	2.0 (1.2)	1.2 - 2.8	2.2 (0.8)	1.0 - 4.3	0.890	1.40	0.25	7.77	0.703
CHBM Cervical Benefits	3.6 (0.6)	3.2 - 4.0	4.1 (0.7)	1.6 - 5.0	0.304	2.51	0.41	15.49	0.322
CHBM Cervical Barriers	1.6 (0.8)	1.0 - 2.2	1.5 (0.5)	1.0 - 3.2	0.825	0.69	0.06	7.79	0.761
CHBM Cervical Self-efficacy	3.9 (0.1)	3.9 - 4.0	4.4 (0.6)	2.9 - 5.0	0.217	3.23	0.36	29.14	0.296
CHBM breast Susceptibility	1.8 (0.2)	1.7 - 2.0	2.4 (0.9)	1.0 - 4.7	0.193	2.42	0.40	14.62	0.335
CHBM breast Severity	2.8 (0.7)	2.3 - 3.3	2.5 (0.8)	1.0 - 4.3	0.396	0.52	0.08	3.43	0.496
CHBM breast Benefits	3.3 (0.4)	3.0 - 3.6	3.9 (0.6)	2.4 - 5.0	0.116	6.40	0.44	92.78	0.174
CHBM breast Barriers	2.1 (0.2)	2.0 - 2.3	1.5 (0.5)	1.0 - 2.7	0.064	0.04	0.00	2.18	0.114
CHBM breast Self-efficacy	4.0 (0.0)	4.0 - 4.0	4.5 (0.6)	2.3 - 5.0	0.212	3.40	0.48	23.84	0.218
CHBM colon Susceptibility	2.2 (0.9)	1.0 - 3.0	2.4 (0.8)	1.0 - 5.0	0.559	1.47	0.42	5.12	0.547
CHBM colon Severity	3.0 (0.5)	2.7 - 3.8	2.5 (0.8)	1.0 - 3.9	0.194	0.35	0.07	1.75	0.202
CHBM colon Benefits	3.6 (0.3)	3.2 - 4.0	4.1 (0.6)	3.0 - 5.0	0.094	5.99	0.59	60.50	0.129
CHBM colon Barriers	2.3 (0.5)	2.0 - 3.0	1.6 (0.5)	1.0 - 2.9	**0.020**	0.06	0.01	0.63	**0.019**
CHBM colon Self-efficacy	4.0 (0.0)	4.0 - 4.0	4.4 (0.6)	1.0 - 5.0	0.122	2.05	0.68	6.20	0.202

(Step 3): Knowledge plus CHBM and Adherence

Mediator	Path A Beta (SE)	Path B Beta (SE)	Sobel Test p-value
CHBM cervical susceptibility	-.0113622 (.0029)	.7372744 (.3360)	0.058
CHBM cervical severity	-.0074234 (.0031)	.7775092 (.3041)	0.273
CHBM cervical benefits	.0074851 (.0021)	.2722837 (.4118)	0.516
CHBM cervical barriers	-.0088989 (.0019)	-1.21684 (.4232)	0.015
CHBM cervical self-efficacy	.0100742 (.0023)	.4605005 (.3373)	0.194
CHBM breast susceptibility	.0057549 (.0047)	.1223047 (.3076)	0.705
CHBM breast severity	.0019677 (.004589)	-.1322891 (.3078)	0.762
CHBM breast benefits	.0071696 (.0033)	-.7573124 (.4348)	0.179
CHBM breast barriers	-.0095772 (.0029)	-.9601638 (.4823)	0.088
CHBM breast self-efficacy	.0090144 (.0030)	.6352793 (.4493)	0.201

Estimates and 95% confidence intervals of knowledge, CHBM constructs, and adherence

Characteristic	N	Proportion	95% UB	95% LB
Knowledge score	467	66.35	64.97	67.73
Cervical Susceptibility	343	1.87	1.79	1.96
Cervical Severity	343	2.65	2.57	2.74
Cervical Benefits	343	4.04	3.98	4.10
Cervical Barriers	343	1.44	1.39	1.50
Cervical Self-efficacy	343	4.40	4.33	4.47
Breast Susceptibility	183	2.45	2.32	2.57
Breast Severity	183	2.64	2.52	2.76
Breast Benefits	183	3.85	3.76	3.94
Breast Barriers	183	1.55	1.48	1.63
Breast Self-efficacy	183	4.45	4.37	4.53
Colon Susceptibility	119	2.39	2.24	2.54
Colon Severity	119	2.57	2.43	2.72
Colon Benefits	119	4.12	4.02	4.22
Colon Barriers	119	1.65	1.55	1.75
Colon Self-efficacy	119	4.42	4.31	4.53
Pap test adherence	322	0.87	0.83	0.90
HPV test adherence	219	0.81	0.75	0.86
Pap test (hysterectomy excluded)	270	0.91	0.87	0.95
HPV test (hysterectomy excluded)	192	0.83	0.77	0.88
Mammogram adherence	169	0.85	0.79	0.90
Blood test adherence	30	0.13	0.04	0.31
Colonoscopy adherence	97	0.96	0.90	0.99
Colonoscopy or blood test adherence	93	1.00	0.96	1.00*

Appendix O

Association and Logistic Regression Models Assessing Demographics on Adherence

Pap test

Effect	Non Adherent N	Non Adherent %	Adherent N	Adherent %	p-value	OR	LB	UB	p-value
Age									
21 - 40	5	21.74	128	51.82	**0.014**	1.00	1.00	1.00	
40 - 50	9	39.13	69	27.94		0.30	0.10	0.93	**0.037**
>=50	9	39.13	50	20.24		0.22	0.07	0.68	**0.009**
Profession									
Clinician	3	13.04	75	30.36	0.177	1.00	1.00	1.00	
Nurse	14	60.87	108	43.72		0.31	0.09	1.11	0.072
Ancillary	6	26.09	64	25.91		0.43	0.10	1.77	0.242
Years of service									
0-5 years	7	31.82	110	44.9	0.544	1.00	1.00	1.00	
6-10 years	5	22.73	44	17.96		0.56	0.17	1.86	0.344
11-20 years	9	40.91	82	33.47		0.58	0.21	1.62	0.299
20 +	1	4.55	9	3.67		0.57	0.06	5.18	0.620

HPV

Effect	Non Adherent N	Non Adherent %	Adherent N	Adherent %	p-value	OR	LB	UB	p-value
Age									
21 - 40	11	33.33	83	52.2	0.134	1.00	1.00	1.00	
40 - 50	14	42.42	50	31.45		0.47	0.20	1.12	0.090
>=50	8	24.24	26	16.35		0.43	0.16	1.18	0.103
Profession									
Clinician	8	24.24	56	35.22	0.395	1.00	1.00	1.00	
Nurse	17	51.52	64	40.25		0.54	0.22	1.34	0.183
Ancillary	8	24.24	39	24.53		0.70	0.24	2.01	0.504
Years of service									
0-5 years	9	28.13	74	46.54	**0.012**	1.00	1.00	1.00	
6-10 years	6	18.75	33	20.75		0.67	0.22	2.03	0.478
11-20 years	14	43.75	51	32.08		0.44	0.18	1.10	0.080
20 +	3	9.38	1	0.63		0.04	0.00	0.43	**0.008**

Mammogram

Effect	Non Adherent N	Non Adherent %	Adherent N	Adherent %	p-value	OR	LB	UB	p-value
Age									
40 - 50	14	56	64	44.44	0.385	1.00	1.00	1.00	
>=50	11	44	80	55.56		1.59	0.68	3.74	0.287
Profession									
Clinician	3	12	46	31.94	0.125	1.00	1.00	1.00	
Nurse	16	64	71	49.31		0.29	0.08	1.05	0.059
Ancillary	6	24	27	18.75		0.29	0.07	1.27	0.101
Years of service									
0-5 years	4	16.67	20	14.08	0.393	1.00	1.00	1.00	
6-10 years	7	29.17	24	16.9		0.69	0.18	2.68	0.588
11-20 years	11	45.83	87	61.27		1.58	0.46	5.48	0.470
20 +	2	8.33	11	7.75		1.10	0.17	7.00	0.920

Colon

Effect	Non Adherent N	Non Adherent %	Adherent N	Adherent %	p-value	OR	LB	UB	p-value
Profession									
Clinician	0	0	28	30.11	0.520	1.00	1.00	1.00	
Nurse	3	75	47	50.54		0.87	0.08	8.92	0.907
Ancillary	1	25	18	19.35		1.00	1.00	1.00	
Years of service									
0-5 years	1	25	9	10.23	0.113	1.00	1.00	1.00	
6-10 years	0	0	18	20.45		1.00	1.00	1.00	
11-20 years	1	25	48	54.55		5.33	0.30	93.30	0.252
20 +	2	50	13	14.77		0.72	0.06	9.22	0.802